THE BRICKBUILDER

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ON THE USE OF BRICK IN ECCLESIASTICAL ARCHITECTURE.

IT is undeniable that a very distinct prejudice exists against brick and terra-cotta in ecclesiastical architecture,— a prejudice which very largely prevents the use of these permanent, fireproof, universally accessible, comparatively inexpensive materials in any church work, save that of the Roman Catholics and of certain of the Protestant denominations. Now I believe that this prejudice, though originally justifiable, and almost unavoidable at one time, is very unfortunate and no longer to be defended; therefore I wish to enter a plea for the use of materials which possess so many elements of excellence, and which are at present, in this connection, so grievously misjudged.

Let us see why this feeling exists. The reasons are not hard to find. They are, it seems to me, three in number: first, the lamentable nature of most contemporary ecclesiastical brickwork; second, the instinctive prejudice against a material which appears to be wanting in precedent, together with the feeling that brick and terra-cotta are not adaptable to the Gothic style; third, unfamiliarity with the possibilities of the materials.

Let us briefly consider these in order. In the first place, it is hard to see how an intelligent architect or building committee could help being prejudiced against brick in this connection, in view of the ecclesiastical horrors that are so much in evidence. The architects of modern Roman Catholic churches manifestly have no scruples against using brick, which is, in a way, unfortunate; for nothing worse from a religious, artistic, or educational standpoint could be imagined than the barren, idiotic, and blasphemous atrocities that deface the innocent landscape and misrepresent the Church. In this particular class of work, brick is used with no knowledge or appreciation whatever of its possibilities. A very hard, smooth face-brick, laid in American bond, with white granite trimmings and galvanized iron ornamentation, is the accepted formula; a sight of one of the resulting dreary and impious structures is about enough to impel a sane observer to refuse brick for church work forever.

Nor is the ordinary religious edifice of many of the denominations much better when brick is used. Here the cherished red face-brick of the Roman Catholic architect gives place to the blotched and mottled and spotted, yellow and snuff-colored and orange "Roman bricks," so dear to the heart of the newly fledged architect. Now the white granite trimmings yield to richly moulded terra-cotta, a dead red color probably, and with equal probability modelled in the "tasty" style of the mortuary sculptor. The tawdry, uneasy, undignified result is not edifying, and it is small wonder that many men, looking aghast at these examples of brick church work, finding them to possess no single element of historical suggestion, beauty, or morality, forsake forever burnt clay and all its works.

Now, of course, misuse of a material does not argue impossibility of right use. A wall of soft-surfaced, stone-gray brick, laid in English or Flemish bond, with gray mortar in wide joints, is just as fine and dignified a wall as one of stone. Possibly it is not as beautiful, but it is equally strong, just as durable, and much cheaper; and this last argument is not to be disregarded. It *is* more dignified and beautiful than the popular rubble or quarry-faced work, which, except in the most rural localities, is inadmissible. There are many shades of good brick now available, ranging all the way from dark red through the browns to light gray; and though the cream bricks can seldom be used except under very particular circumstances, and the hot, yellow, mottled bricks almost never, still the range of colors is large, and bricks are easily obtained which have the rough surface, quiet tone, and varied color which are to be found in ordinary building stones.

In the matter of terra-cotta, the same holds good. The cheap, red, mushy stuff affected by the "tabernacle" and the "temple," and the flaring white Renaissance products consecrated to hotels and club-houses, are not all there is obtainable. There is a gray terra-cotta which is perfectly adapted to Gothic work, particularly to window tracery; and though no modelled ornament can ever equal fine carving in the solid stone, it is oftentimes far better than the coarse and crude, or weak and lifeless apologies that are offered by the ordinary stone-cutter.

For window tracery alone terra-cotta is invaluable. It does not pretend to be stone, but it is absolutely permanent, and infinitely to be preferred to the makeshift and hypocritical wooden work which is only justifiable when it is considered as a temporary stop-gap.

Again, I do not believe that brick and kindred materials are impossible in interior work just because we have a few forbidding examples of pressed brick interiors which have nothing to commend them. The confusing, spotty effect of brickwork when seen close at hand, particularly where it is not subject to the mellowing influence of the weather, militates against its use in this particular instance; but I am confident that experiments and experience will make possible the use of brick and terra-cotta for interior work, though at present we have hardly an example of its successful application. If a brick or large slab of terra-cotta, say one foot by one foot eight inches, could be obtained, it might obviate the now distinct difficulties.

Coming to the second reason of the prejudice against brick, objection to it on historical grounds, it seems to me that there is less excuse than in the first case. If architecture is anything but a fad, it is a living art, based on precedent and history it is true, but adapting itself absolutely to modern conditions and demands. An architecture which is unerringly archæological is just as unworthy as one that is entirely "emancipated." During the great periods of Gothic or Christian architecture in the North, brick was not available, neither was it necessary. The time was not yet come when personal extravagance and luxury had made thrift and economy necessary in religious

duties, and therefore stone, and the *best* stone, was not thought too good for a church. Now, however, conditions have changed, and cost must be counted in every instance. As a result wooden churches must do in many cases; for the money that would formerly have been generously given is now lavished on the private dwelling and the club-house, and there isn't much left for God. Under these circumstances the tremendous advance in brick-making seems to be a very fortunate thing, for it makes possible a dignified and permanent structure in place of the scandalous wooden makeshifts that do small honor to our religious sense. There isn't the least doubt but that the church builders of the fourteenth and fifteenth centuries would have used this material gladly under the same conditions that confront us, and out of its very limitations they would have created triumphs. In the South of Europe it *was* used and with most noble results, and it is just as applicable in the North as there. Because it was used only in the work of the early Renaissance in Italy, it does not follow that it might not have been used equally well in the developed Gothic of England and France, or that it might not be used in the Restoration work of the present day. In reasonably competent hands it could not help being immeasurably better and more dignified than the silly and affected rubble work that is so popular now under the mistaken idea that it is "rural" or "picturesque," while as a matter of fact it is only absurd. For any work except that of the roughest and most brutal nature, it is absolutely necessary that the wall surfaces should be nearly smooth, and the only way this effect can be obtained, except at the great cost of dressed stone, is by the use of seam-faced stone or brick; the former is not always obtainable, the latter always.

And obtainable in good shape, for the special and expensive bricks are by no means always the best in effect. A good common brick, varying to any extent in color, laid up in Flemish or English bond, makes a fine wall, quiet, reserved, and dignified. Also it is cheap, or would be so beyond competition, if only the brick manufacturers would make their bricks of a size which would make an honest bond possible without chopping half the bricks. If common bricks came, say 2 in. x 4 in. x 8¼ in., or 1⅞-in. x 3⅞ in. x 8 in., a wall could be laid up in a good bond for just about the cost of the ordinary wall, which really isn't bonded at all, except perhaps every five courses, or else by metal makeshifts. It is strange that so small a change as this, and one which would increase the popularity of brick so largely, is not made. The ordinary unbonded wall is ugly, and will forever remain so. The Flemish or English bonded wall is beautiful in itself, as well as strong and sane in construction. I really believe that much of the unpopularity of brick comes from the impossible shapes, and for these the manufacturers alone are responsible.

As for the third reason that I have assigned, there is unfortunately nothing to be said. If architects will only look up the matter they will find a lot of good bricks, good in everything but shape, easily available, and they will surely realize that there is no reason, architectural or otherwise, why brick should not be used in church work without hesitation; while by refusing it they are only injuring themselves, since they are compelled either to build useless wooden structures or else to spend their allowances on heavy walls of stone which, nine cases out of ten, are unsatisfactory in final effect, owing to the fact that money is not forthcoming for anything but quarry-faced stone, — an ecclesiastical abomination.

The same holds good in terra-cotta, and if architects will forget the mushy stuff that is so often the only thing common in this material, and forget also the horrors in "quarry-faced stone brick" and their ilk, they will, I am sure, find that they have been carelessly throwing away a great chance for noble work.

Of course there is another factor to be dealt with, the building committee, and here at present reform seems almost hopeless. I have never found yet a building committee that would consider brick for a moment, and from their standpoint, that of observers of contemporary ecclesiastical brickwork, I can't blame them. In England this prejudice has been overcome, and it must only be a question of time in America before the same result is achieved here. There is too much to be said in favor of brick, too little against, to allow the present prejudice long to continue.

Let us look at these favorable points a little more carefully. In the first place, brick is absolutely permanent, fireproof, and solid. Good brick will endure pretty nearly forever. This is a great point; for if a church should be anything, it should be honest and permanent. In the second place, it is easily obtainable, for there is no place in this country where it cannot be procured with the greatest ease. Of its rivals, dressed stone and seam-faced stone, or stone that has a flat cleavage, the first is very expensive, the second not to be obtained everywhere, by any means. Quarry-faced stone I can't look on as a rival, for it has no historical precedent whatever, and is uneasy and undignified in effect. In the third place, brick is comparatively cheap. By using it an architect is able to obtain a substantial and beautiful building, while the amount saved over stone enables him to provide richer mouldings and more elaborate carving in the trimming stone than would otherwise be the case, while he very possibly may be able to place terra-cotta tracery in his windows, and so get rid of the wooden abominations that are such a trial to his sense of fitness and honesty.

On the whole, it is hard to see what there is of adequate argument to be offered against this material. It is characteristic of this age, and being honest and dignified, the objections cannot be brought against it which can be adduced against iron and steel construction, and which must forever prevent their use in church work. For this reason it is the duty of the art of architecture to accept it, mould it to its uses, and make of it a building medium as worthy and honorable as stone has been in the past. It can never supersede this latter, for it can never give a surface as dignified as well-dressed sandstone or as beautiful as seam-faced granite, but it can take a worthy second position, superseding quarry-faced stone and rubble, and making possible in the vast number of cases strong, beautiful, and substantial churches, where now are wooden expedients or nondescript makeshifts made of stray stone walls and cedar shingles.

RALPH ADAMS CRAM.

WE published in our August number a circular window of terra-cotta in the Carnegie Music Hall, New York, and give herewith a capital from the same building. The architect is Wm. B. Tuthill of New York. The terra-cotta is dark buff, executed by the Excelsior Terra-Cotta Company of New York.

STA. MARIA IN COSMEDIN, ROME.

IT is with genuine pleasure that we call the attention of readers to advertising page vii, if by any chance they may have overlooked it. It is the first instalment of the new advertisement of the Hydraulic Press Brick, which was announced two months ago. The decorative border will each month enclose a new photograph of some interesting example of brick architecture. The present subject is the Basilican church of Sta. Maria in Cosmedin, built during the last years of the eighth century. The tower possesses particular interest as being one of the best of the many square brick towers attached to churches in Rome. It is only fifteen feet broad and one hundred and ten feet high. Ferguson says that, "notwithstanding this, there is a great dignity in the design, and, in a city where buildings are not generally tall, its height is sufficient to give it prominence without overpowering other objects."

BRICK AND MARBLE IN THE MIDDLE AGES.

CHAPTER VI. — CONTINUED.

G. EDMUND STREET.

ON the way back from San Zenone into the city a small church is passed, — the oratory of the same saint, — where his body is said to have rested for a time before it was taken to the Basilica. The only architectural features are of a long subsequent period, a very good circular window in the west gable, and a doorway with a pointed canopy supported on shafts above it, under which of old no doubt there was a painting.

Beside San Zenone I think the only very grand church as yet unmentioned is that of San Fermo Maggiore, — a vast Romanesque basilica without aisles, but with small transepts, and a chancel and north and south chancel, — aisles opening into the nave by three arches, which exactly correspond with its vast width; a not very beautiful arrangement, which we shall meet with again in the church of the Eremitani at Padua, and in others of the great churches of the preaching orders of monks.

The fabric of the east end and the eastern half of the nave appears to be of very early date; I should be disposed to say the end of the tenth or beginning of the eleventh century. A lofty crypt is constructed under the whole of this part, all the columns of which are square; some of them mere masses of masonry, others slender monoliths. The mouldings here are rather Roman in character than Lombard. The groining is all of brick, and very extensive remains of paintings are still to be seen throughout, the large columns having single figures painted on them, one on each face. Access to the crypt is obtained (by the clergy) from the cloister, south of the church, and by the people through a very spacious staircase entered from the outside by a door just west of the north porch. So good indeed are the means of access, that no doubt the crypt was once extensively used by the laity, for whom these stairs were specially intended. It is now not used at all, — just as is the case with old crypts all over Europe, — but then it is fair to say that the church is no longer served by the Regular Clergy by whom it was built, and that their conventual buildings were when first I saw them occupied by Austrian soldiers, and are now still turned, I believe, to some equally secular use. I think we may fairly assume that in 1313, when the church was restored and in part reconstructed, the old crypt was retained partly on account of its associations, and partly because of its convenience for those who might at first not quite sympathize with the novel arrangements of the church above, a great unbroken area built and contrived for the use and convenience of an order of preachers, and not for receiving a number of altars.

A monument close to the entrance of the crypt is worth notice. It represents a professor with his pupils sitting each at a desk. The books have inscriptions on them. The professor's has "Vita brevis"; a pupil, "Ars longa"; another, "Judicium difficile"; and another, "Tempus fugit."

ITALIAN BRICKWORK.

1, 2. Windows at Verona.
3. Cornice, S. Ambrogio, Milan.
4. Cornice, Broletto, Brescia.
5. Window in Broletto, Monza.
6. Wall Arcade, San Fermo, Maggiore.

In the interior of the nave we have, as has been observed, a work which has been so much altered that it is in fact, as we now see it, a work of the fourteenth century. It is about fifty feet in width, and covered with a timber roof, constructed so as to form a ceiling of a number of cusps boarded and panelled on the under side, and tied with iron ties in place of collar-beams. Two vertical divisions of the panelling are arcaded and filled with paintings of saints, and the whole roof is darkly stained and richly painted. Beyond this the only very striking feature is the pulpit, which is corbelled out from the south wall about midway in its length. It is old and picturesque, and is surmounted by a delicately carved and lofty canopy, — the whole in marble. It is surrounded by wall paintings of about the same age, and presents a fairly unchanged example of what such combined works of the painter and the architect were in the palmy days of the fourteenth century. These paintings are of much interest. Behind the pulpit are the four doctors and the four Evangelists seated, the ascent of Elisha in a chariot of fire, and twelve prophets with scrolls. Under the canopy is the crucifixion.

Going to the exterior one finds on the north side two transepts, and north of the chancel a tower. East of the eastern transept and of the tower are small apsidal projections of Romanesque character, both of them in ruins and unused. The masonry here is different from that of the later work, being of alternate courses of single brick and of stone.

The exterior of the principal apse is very remarkable, and belongs to the fourteenth century. Each side has a steep gable with elabo-

rate cornices, mouldings, and pinnacles, partly of stone and partly of brick. The gables are built with circular bricks, and there is a cusped circular window in each gable. Seen from the bridge which crosses the Adige close to the church, this picturesque east end is one of the most picturesque things in Verona. Unfortunately, the campanile does not equal in importance the church to which it belongs.

The west end will be best understood by the accompanying sketch.* It is constructed entirely in red brick and warm colored stone, and I confess that it impressed me most pleasantly, as having in its four delicate lancet windows some sort of affinity to our own English work. The north porch is very fine of its kind, and the jambs of its doorway are constructed of black, white, and red marble used alternately. The arcading against the walls is noticeable as showing the use of thin courses of red brick for the purpose of defining the lines of the stonework.

The monuments on each side of the west door are good simple examples of a favorite Italian type. They are, as we shall see, of all dates, and, even when developed to a great size, are still corbelled in the same way out of the walls. In the North of Europe we have no analogous treatment of monumental memorials, and this rather enhances their value. The arch to the monument on the left of the west doorway is painted in a charmingly simple Giottesque style, and there is a painting also behind a modern statue in the door arch, of our Lord surrounded by angels. In the arcades above the monuments there were figures of saints painted, with imitations of mosaic. All these details are worth mentioning in order to give some idea to those who have not seen Verona of the extent to which everywhere the eye is feasted with remains of early art. Indeed, one feasts uninterruptedly there on all that can delight the eye in form and in color.

With the mention of one more church I believe I may bring my notes in Verona to an end, and this is a small chapel which stands just opposite the south side of the Duomo, and whose name I could not learn. It is much like San Pietro Martire in its general arrangement, but remarkable for the exquisite beauty of its windows, the arrangement of the bricks and stonework in which is beyond all praise. These windows are constructed with trefoiled heads of stone, enclosed within an arch of mixed stone and brick, round whose outer edge runs a band of delicate terra-cotta ornament. The spandrels of the trefoils are filled in with refined sculpture, instead of being pierced with the dark eye usually found in northern Gothic. There is, too, an entire absence of mouldings, yet, notwithstanding this, the general effect is one of combined delicacy and richness of no common kind, so much does carefully arranged and contrasted color do for architecture. A third window is entirely of brick, save the trefoil head of the opening. The side elevation of this little chapel is very singular in its whole arrangement; there are three bays divided by pilasters, which finish at the top in an arcaded cornice of brick; in each of the two western bays is a lancet window, and the centre bay has in addition a doorway, and a corbelled out monument above it; in the eastern bay the window looks just like one of those curious English low side windows, as to the use of which we have had so many ingenious theories; the east end has no trace of any window, and is finished with a flat-pitched roof, and a brick corbel-table running up the pediment. There is no stone used except in the window-heads and arches.

There are many other churches in Verona on both sides of the river, and into several of them we went, but without finding any of equal merit to those which I have already noticed. Santa Eufemia has a fair west front, of late pointed, and we found one or two good cloisters just like those mentioned at Brescia. Other churches have fronts built, and interiors remodelled, by Sanmichele and his successors, in a style which by no means approved itself to me; others there were which I did not succeed in reaching † and there is one dedicated in honor of S. Thomas of Canterbury, which is not, however, otherwise of any interest; it has a very late Gothic west front, of poor character.

It is impossible to walk about Verona without meeting at every turn with windows whose design is similar to those so often seen in Venice, but the execution and arrangement are generally so inferior here to what they are there, that I shall defer saying much about them until I am describing the palaces and ancient buildings of Venice. They are almost always finished with ogeed trefoils at the top, and are arranged singly, or in couples or more together, and one above the other, the same in each story of the house; their mouldings are thin and reedy, and the carving of their finials, when they have any, is very poor. Examples of these windows will be seen by most travellers in the rooms of the Albergo delle Due Torre.

The views from the bridges across the Adige are very striking. The main part of the city is on the right bank, and the river describes nearly a semicircle round it. The opposite bank is only partially built over, and has a largish suburb, upon rather rapidly rising ground; beyond this the walls of the city are seen with occasional towers, and marked all the way by their serrated battlements climbing the irregular outline of the hills in the boldest fashion. Then crossing over to the other side and turning round, you see the thickly built city full of towers and churches rising far above the turmoil of the crowd below into the pure sky, and, by their number and size, making Verona one of the most striking old cities I know.

Of course no one goes to Verona without thinking of Romeo and Juliet. I fear, however, that when I was shown the Casa de' Cappelletti, a small inn in a narrow street, and asked to connect it in any way for the future with the creation of Shakespeare's brain, my fancy refused to be sufficiently lively to perform the required feat. The simple fact is that real relics not existing, the good people of Verona have wisely met the demand which Shakespeare has created, and have discovered a tomb for Juliet, and other reminiscences of the fair Veronese, which I dare say satisfy very well the majority of travellers.

At Verona, as in the other towns through which we passed in Italy, we were quite astonished at the number of misshapen dwarfs that we saw; we could not account for this at first, but I suppose it is because children, until they can walk, are tied up in rolls of linen so stiffly as to deprive them of all power of motion. The only wonder is how any of these unfortunate children ever manage to walk at all.

In the courts of the houses at Verona there are generally wells, with ingeniously contrived arrangements for enabling the occupants of the various surrounding houses and balconies to let down their buckets for water without themselves going down to the wells. There are guide-ropes to the well from each angle of the courts round which the houses are usually built, along which the buckets run, suspended by rings and held by ropes from the balconies, until they reach the iron-work over the well, and then fall perpendicularly down to the water.

I have visited Verona many times, and each visit seems to me to give greater pleasure than the last. I fear I have given but a faint idea of the indescribable charm which it has to all who are fond of early art. There is little which one can compare with the situation and surroundings of such cities as Venice and Florence, and yet I suppose most travellers would agree with me in reckoning the interest of these three towns as not far from equal, and greater in very many ways than that of any other Italian cities.

On this first journey we were driven away by bad weather which, when it sets in, generally continues for several days, and we left, inwardly resolving that no long time should elapse before we returned, — a resolution which has been abundantly and often fulfilled — and as the waiter at our hotel honestly told us that we should be very likely to find fine weather at Padua, whither we were next to journey, we took his advice, and then, getting into an omnibus contrived to hold thirty persons, and I should say at least twenty feet long, with four horses harnessed with long drawn-out traces to increase the already prodigious length, we were soon at the terminus of the Verona and Venice railway.

(*To be continued.*)

* The sketch in the original is replaced by the photograph on Plate 73.

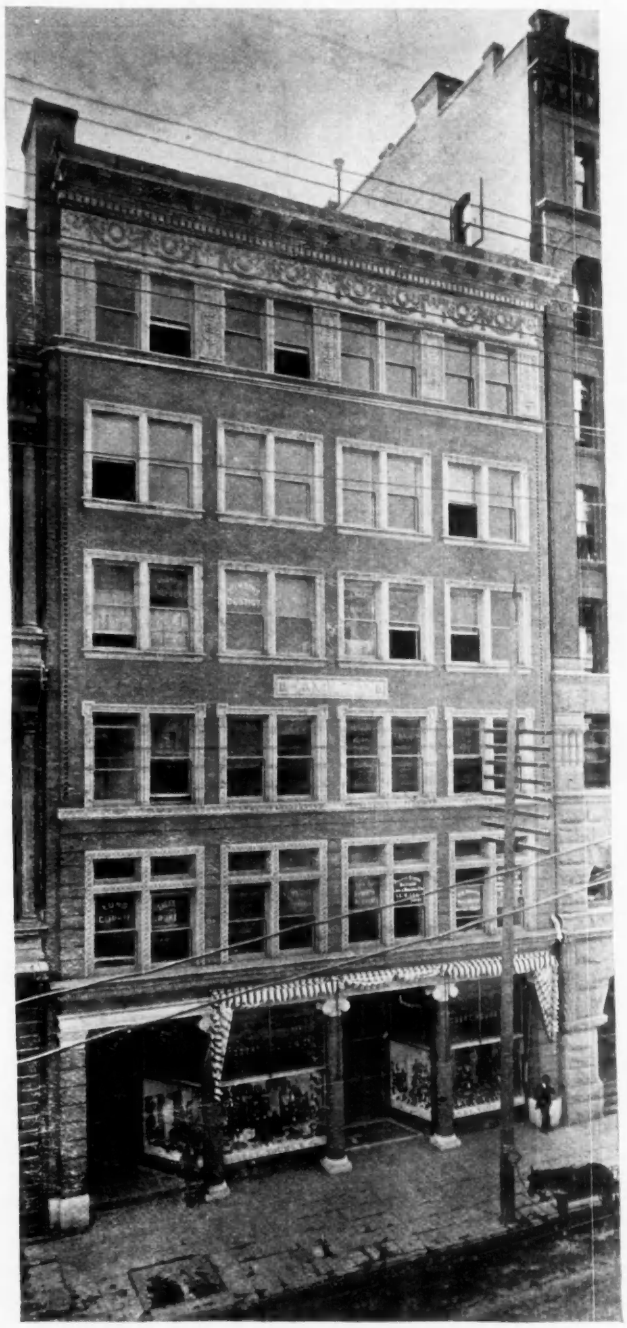
† The most important of these is the interesting church of San Stefano in the suburb on the opposite side of the Adige. It has been much modernized, but has still, I believe, an early crypt and an octagonal steeple over the crossing, of the same age as San Zenone.

RECENT BRICKWORK IN AMERICAN CITIES

PORTLAND, OREGON.

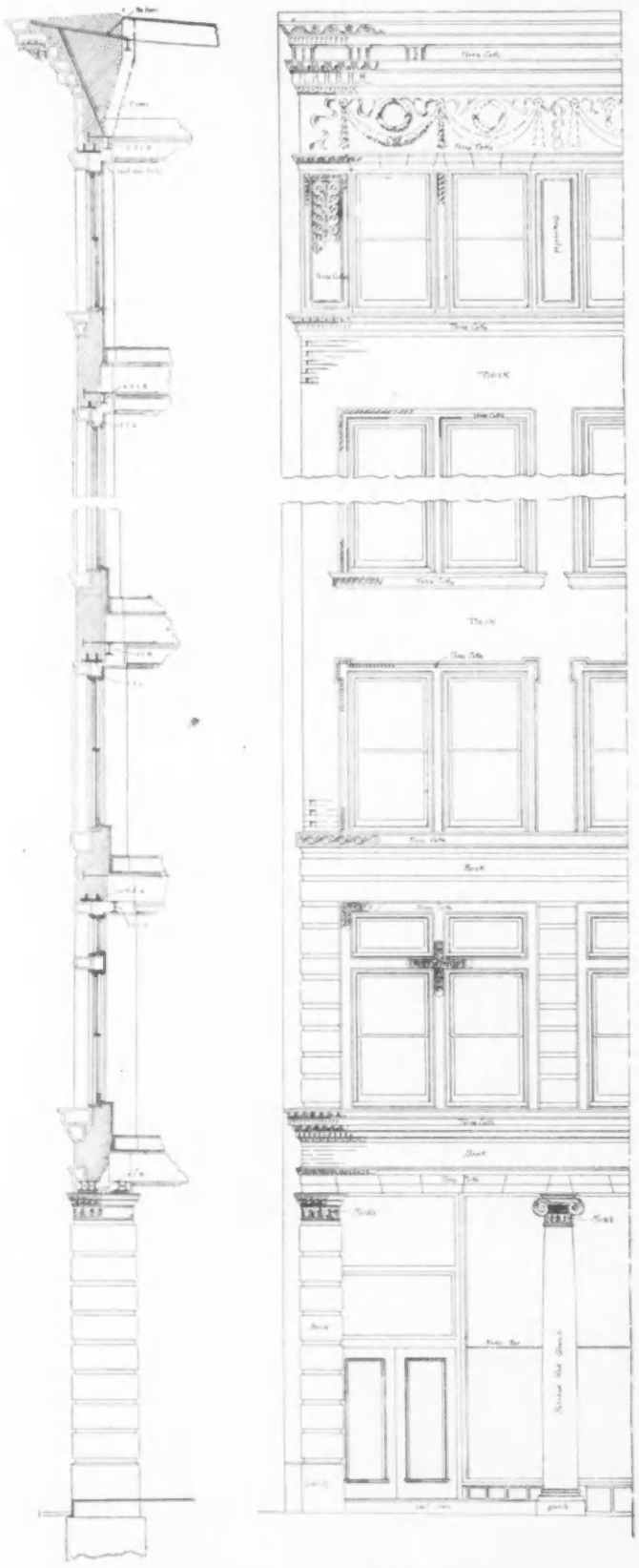
THE history of brick and terra-cotta in Portland is of a somewhat short period, the earlier buildings being of the style and character peculiarly in vogue on the Pacific coast, — usually a conglomeration or mixture of stone, brick, cast iron, and galvanized iron, with an abundant quantity of the latter for the purpose of decoration; all of the buildings, hardly without exception, having a cement plastering worked to a smooth surface, sometimes blocked to imitate stone and moulded for architraves and belt courses. The primary reason for the cementing is to exclude the moisture, which is a very important item in this climate, where the heavens weep, with but short intermissions, almost eight months in the year; not that there is a large fall in point of number of inches, but a continual drizzle, popularly and aptly termed Oregon mist. It is only within the last four or five years that ornamental brick and terra-cotta have been used in any degree of pretence to architecture.

Although contiguous to a mountainous country, stone is not so varied and abundant nor so high in quality as it would seem it should be. Clay, therefore, ought, next to wood (which is the king of products for this section), become the most important building material. As yet there has been but a small quantity manufactured for the purpose of artistic building material, which might be attributed to the scarcity of good clays, but, I think, rather to the heretofore lack of demand and probable want of capital. The greater part of face and ornamental brick and terra-cotta has been imported, some from the Eastern States, and more from California. Not a small number of common brick which, at the same time, if selected, make a handsome face brick, come from Japan. These brick are of a beautiful salmon red, larger than the domestic brick, the dimensions being two and one fourth by four and three eighths by nine inches, are of a good quality, and were obtained at a price that stood competition during the busy times. These brick have been used in several prominent buildings, and show off to fine advantage.



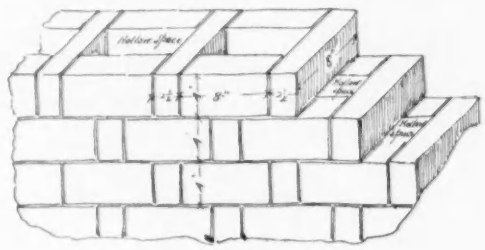
HAMILTON BLOCK, PORTLAND, OREGON.
WHIDDEN & LEWIS, ARCHITECTS, PORTLAND.

The method of construction in brickwork here is about the same as throughout the country, possibly having an advantage in the quality of lime which is made on Puget Sound, and which is hardly equalled in quality as well as price; also in the matter of cement, which usually forms the greater part of the cargoes of vessels coming here to load wheat and lumber. One of the peculiar methods of brick construction is found in a residence (illustrated). The walls rest on an ordinary foundation wall twelve inches thick, and are carried up two stories eight inches thick, laid with the usual Flemish bond, except that the brick are set on edge. This house has been standing for fifteen years, and stands to-day as well as the day it was erected. The builder claims it to be stronger than the same wall laid up eight inches thick in the usual way. It has the advantage of a hollow



DETAIL OF THE HAMILTON BUILDING, PORTLAND, OREGON.
WHIDDEN & LEWIS, ARCHITECTS.
Reproduced to scale of one eighth inch.

space from bottom to top, at which points are left openings for the free circulation of air during the dry season, this space being a very important item in the obstruction of dampness from the outside, the need of which has already been mentioned. The item of expense, which amounts to fully twenty-five per cent in the saving of material and about the same in labor, also seems an advantage for the ordinary class of residences and other light buildings.



Sketch showing method of laying brick

The progress in brick and terra-cotta can be seen in the Hamilton Block (illustrated). This building is faced with a mottled buff-colored Roman brick, trimmed with white terra-cotta of very ornate design, making a very handsome and effective piece of architectural work. J. J.

PRESBYTERIAN BUILDING, NEW YORK.
ROWE & BAKER, ARCHITECTS.
FRONT BRICK AND FIREPROOFING FURNISHED BY THE RARITAN HOLLOW AND POROUS BRICK COMPANY.

THE ART OF BUILDING AMONG THE ROMANS.

Translated from the French of Auguste Choisy by ARTHUR J. DILLON.

CHAPTER II. — CONTINUED.

I.

VAULTS WITH ARMATURES WITH RADIATING JOINTS.

THE ribs with converging joints were made ordinarily of two kinds of brick, one square, of about two (2) ancient feet (a little less than than 6.0 centimetres) on the side, the other rectangular and about two feet

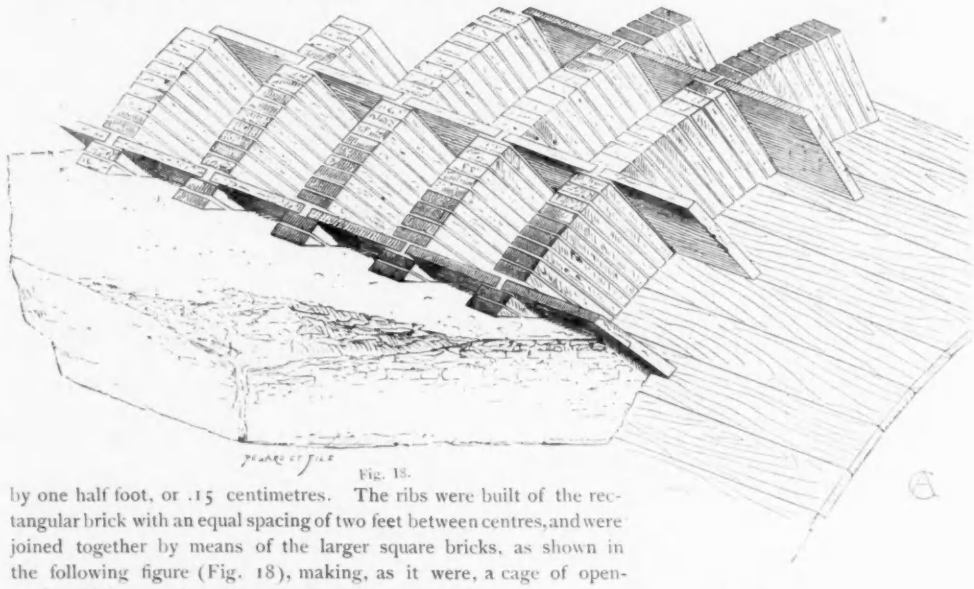


Fig. 18.

by one half foot, or .15 centimetres. The ribs were built of the rectangular brick with an equal spacing of two feet between centres, and were joined together by means of the larger square bricks, as shown in the following figure (Fig. 18), making, as it were, a cage of openwork which may be taken as the best type of the armatures with radiating joints.

Sometimes, though this variation is very rare and is more probably the result of carelessness than of system, the larger bricks used for bracing, instead of following along the same generators of the vault, were so placed that they reached quite through the ribs they joined (Fig. 19), a doubly vicious arrangement, because not only was a larger number of bricks required to cover the same space as in the first arrangement, but it was also more difficult to properly place the filling on account of the narrowness of the cells. It is true that a greater stability was assured by the greater number of vaults, but as the other system gave quite sufficient stability for even the largest vaults, and as these armatures were essentially only auxiliary works, the Romans would seem to have been right in sacrificing this slight increase in strength for the more important considerations of lightness and economy.

The system, of which the first type is an example, was applied in a remarkable manner in the construction of one of the halls in the palace of the Cæsars at Rome, which is one of the group of buildings near the great circus. I have shown the vault in the first plate, and in order to make the general system of ribs more evident, and to show the relation with the supports, I have drawn a series of sections and arrachments which give all the details of the construction, and sum up all that I have so far said, both of the construction of vaults and of the general construction of Roman masonry. One can here see the analogy of construction between the rubble of the vaults and that of the piers, in the horizontality of the courses in both masses as well as the more noticeable analogy between the network on the intrados of the vault, and the revetment of triangular bricks which envelop the piers.

This plate shows what is perhaps the most perfect type of ancient armatures, for the network of bricks is at the same time a most rigid support and a continuous revetment. But this combination of merits necessitated an excessive number of bricks, and the Romans, sacrificing in the skeletons of their ordinary vaults these too dearly bought advantages, departed from this type little by little, and passed from a system of continuity to one of the most complete discontinuity, from the networks of bricks to the single engaged ribs. I will later endeavor to show the successive steps of these simplifications or variations. But in connecting the examples still to be cited with the preceding type, let it be borne in mind that I do not pretend to retrace the historic relation of the things themselves nor the progress of the different processes. The relative dates of the different vaults which we are to compare are ordinarily so doubtful that it would be foolhardy to pretend to know, at the present state of archæological knowledge, the true succession of the Roman methods. I will try only to show through the diversity of forms the dominant thought which decided the principal arrangement of the permanent centring of the ancient vaults.

If, bearing this in mind, one compares the vault in Plate I. with those in Plates II. and III. (drawn to the same scale), he will find that they are all connected by the same general principle, which has its completest expression in the vault of the Palatine.

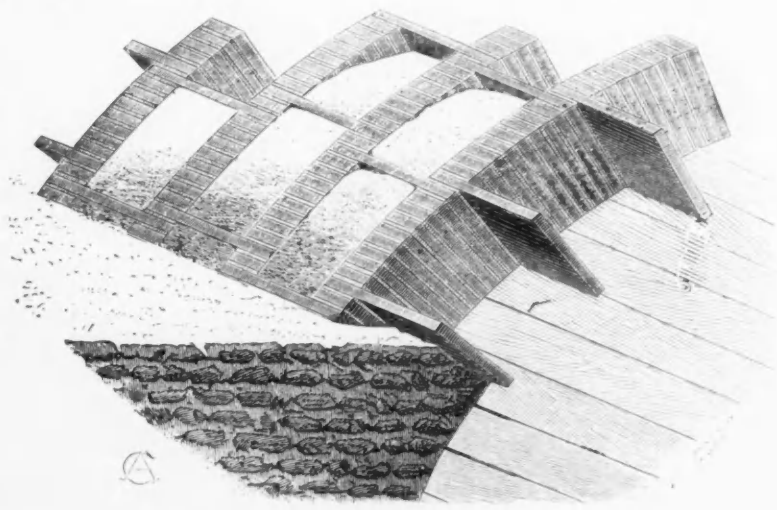


Fig. 19.

In the first figure of Plate II. the ribs are no longer directly joined together by the square bricks, and their contiguity alone is the only approach to continuity. The skeleton of the vault is reduced to a

system of isolated ribs, fifteen centimetres in width, separated by a space too large to be spanned by means of bricks of the ordinary size. Therefore, the space between them is not divided into cells, but the bricks two feet square placed here and there in the ribs project from either side, making, as it were, headers in the rubble. Though not entirely dividing the interval between the ribs into cells, they form well-marked divisions, and almost make up for the inconveniences of the discontinuous armature. Each sustaining rib, cleared of the rubble, would have the appearance of Fig. 20. The wings, the projections of the greater bricks, catch, to a certain extent, in the masonry of the filling, and prevent its bearing on the centring, for it is evident that its adherence to the salient wings of the ribs would bring the greater part of the weight on to the armature, instead of allowing it to rest on the temporary scaffolding. This vault is characteristic of the first effort of the builders to free themselves from reliance on a complete network, and from the consequent expense, while still keeping the advantages of continuity. It is taken from the arcade of the aqueducts said to be that of Nero, of which the ruins are still to be seen built in the walls of the gardens along the street leading to the church of St. Stefano Rotunda in Rome.

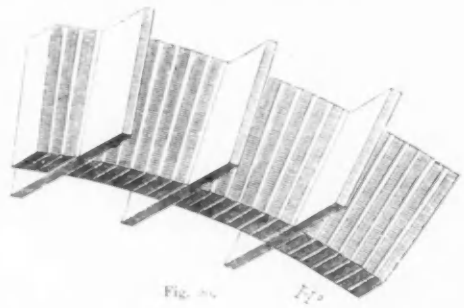


Fig. 20.

The closest attention is necessary to perceive the arrangement shown in the figure: the rubble is of tiles of the same color as the armature, and the armature itself is so roughly built that it is needful to be aware of its existence in order to trace it through its envelope, whose tint adds to the difficulties of seeing it, which arise from its ruinous state and its rude construction. I said, in beginning, that it would be necessary to give, in the drawings, a regularity of construction to the supporting works which in reality does not exist, and nowhere am I more under the necessity of taking this liberty than here; but nowhere can one perceive better than in this aqueduct the importance the Romans attached to rapidity in building their armatures. I have given the reason for this haste and one cannot find it more clearly written than in the irregular forms of these arcades.

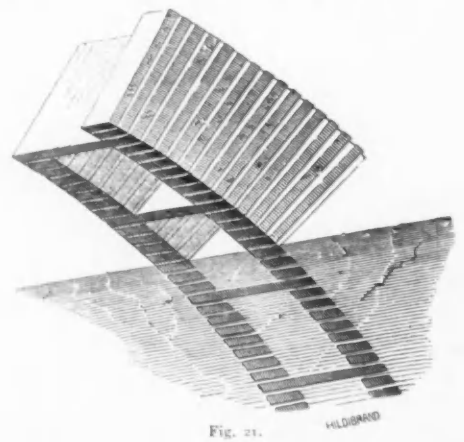


Fig. 21.

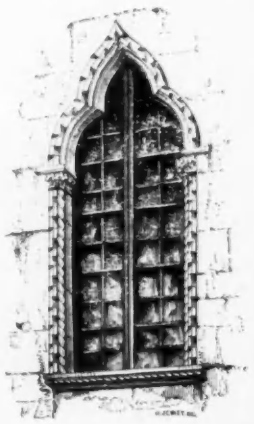
The isolated ribs shown in Fig. 20 were easy to build, but from their slight thickness (about fifteen centimetres) were of an uncertain stability. They were subject to lateral deflexions or to twisting, and the Romans, to make up for the smallness of their section, replaced the arrangement of Fig. 20 by that of Fig. 21 where the arches are joined in pairs.

A rib thus formed of two coupled arches resembles a zone of the network of the Palatine. The superiority of this system over the preceding one is evident, the coupling of the arches increasing the whole width, and thus preventing the danger of deflexion; and it is to be found on a large scale in a great number of edifices, among which is the Coliseum. (Plate II., Fig. 2.)

The figure at the top of Plate II. shows a part of the exterior galleries of the Amphitheatre; two contiguous and parallel galleries of almost equal opening are shown. One only is built with an armature of bricks, the other being built directly on the centring, so that we cannot look on the mode of construction we are studying as a method systematically followed by the architects of the Coliseum; and, in truth, the Coliseum is, from a builder's point of view, a vast summing up of the art of building where every method known in ancient days was used: be it that the vaults have been reconstructed at different periods, be it that its original construction was undertaken by contractors to whom was given a certain amount of liberty in the choice of methods, it is still to be remarked that in different vaults, sometimes in different parts of the same vault, there are to be found most widely different ones. The barrel vaults seem generally to have been built on engaged ribs whose form and arrangement are sufficiently shown in the drawing; but there does not seem to have been any absolute rule either for the distribution nor for the construction of the ribs; sometimes they commence at the springing of the vaults, sometimes at a much higher level, sometimes their axes coincide with the architectural divisions, sometimes (as in Plate II.) the small arches carried on stone pilasters are placed eccentrically in regard to the skewbacks which take the thrusts. With but a little thought, the architects could have made the ribs a decorative feature of the vaults; but they preferred these incorrections to the risks attached to the otherwise slow building of these consolidating members, and trusted to a thick plastering, applied afterwards, for concealing the irregularities of structure. This negligence is common in the major part of the armatures which we will later take up; but before going further it will be better to analyze in a more exact manner the functions of the armatures we have just described.

(*To be continued.*)

NOTE.— Plate I. was published in May, Plates II. III., and IV. in August.



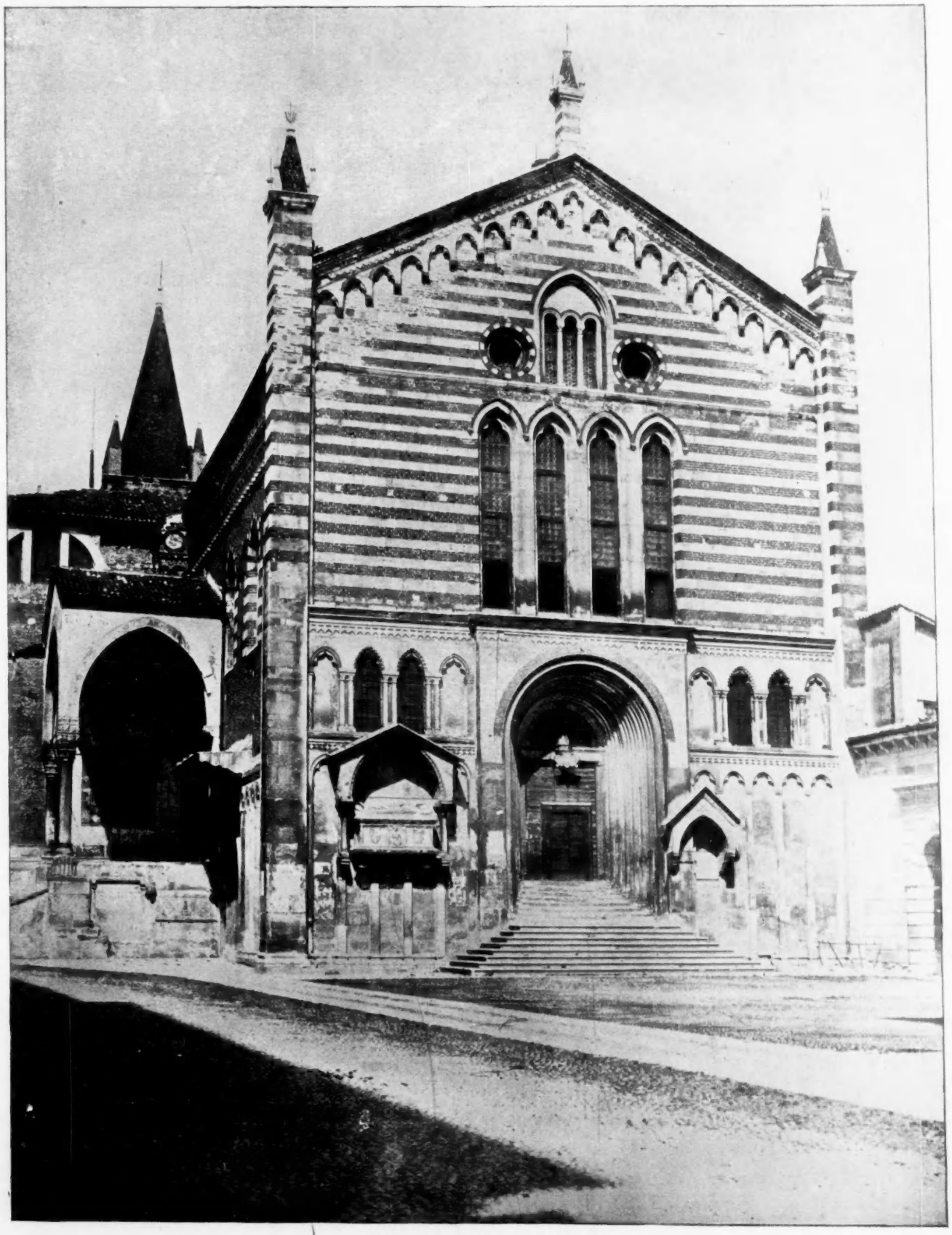
THIS illustration was crowded out of the regular pages devoted to streets, "Brick and Marble," and is here inserted. It is referred to at the top of the second column on page 198.

MR. A. H. BOWDITCH and Mr. J. E. Chandler have moved their architectural office to 85 Devonshire Street, Boston, the former from 131 Tremont Street, the latter from 9 Park Street.

MESSRS. WARREN & BACON will dissolve partnership, Mr. Warren continuing at his office, 9 Park Street, Boston.

MR. WM. Y. PETERS, architect, moves, November 1, from 13 School Street to 6 Beacon Street.

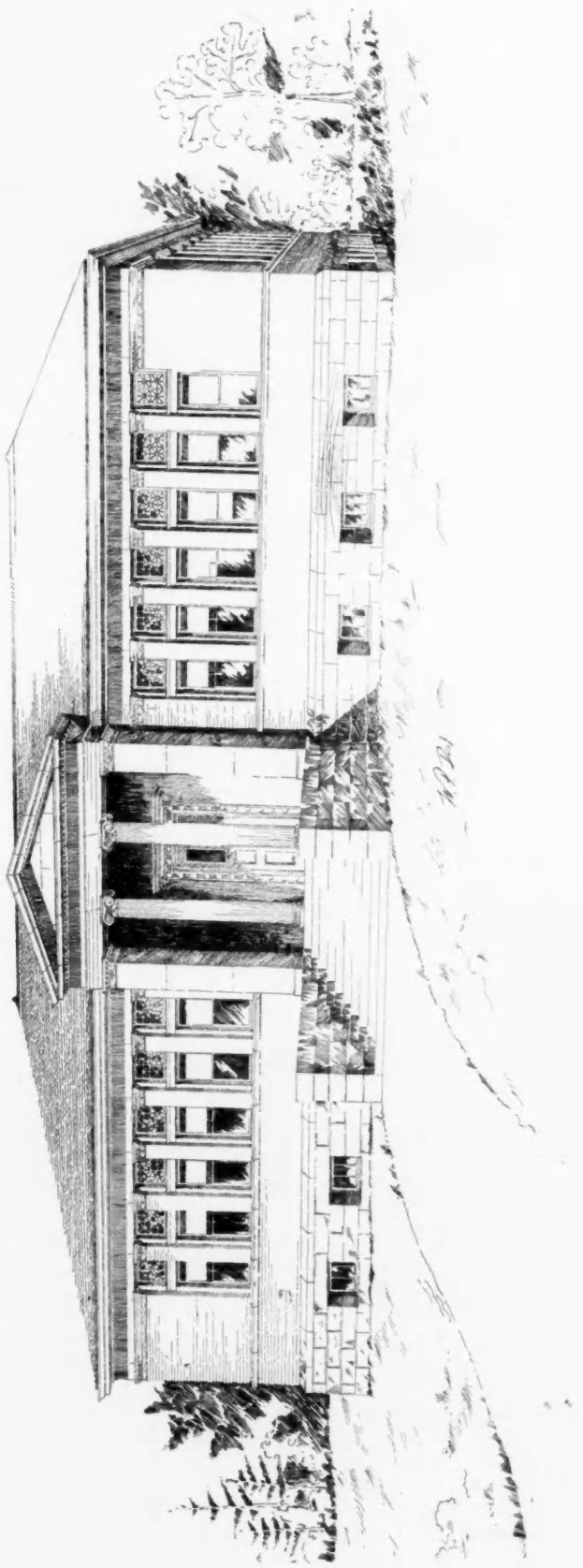
FR. VON EMPERGER, of 71 Broadway, New York, announces some tests of the Melan floor, of six and seven feet span. The samples will be manufactured at a yard on 19th Street and North River, before November 1, and the exact time of the tests may be obtained from Mr Von Emperger.



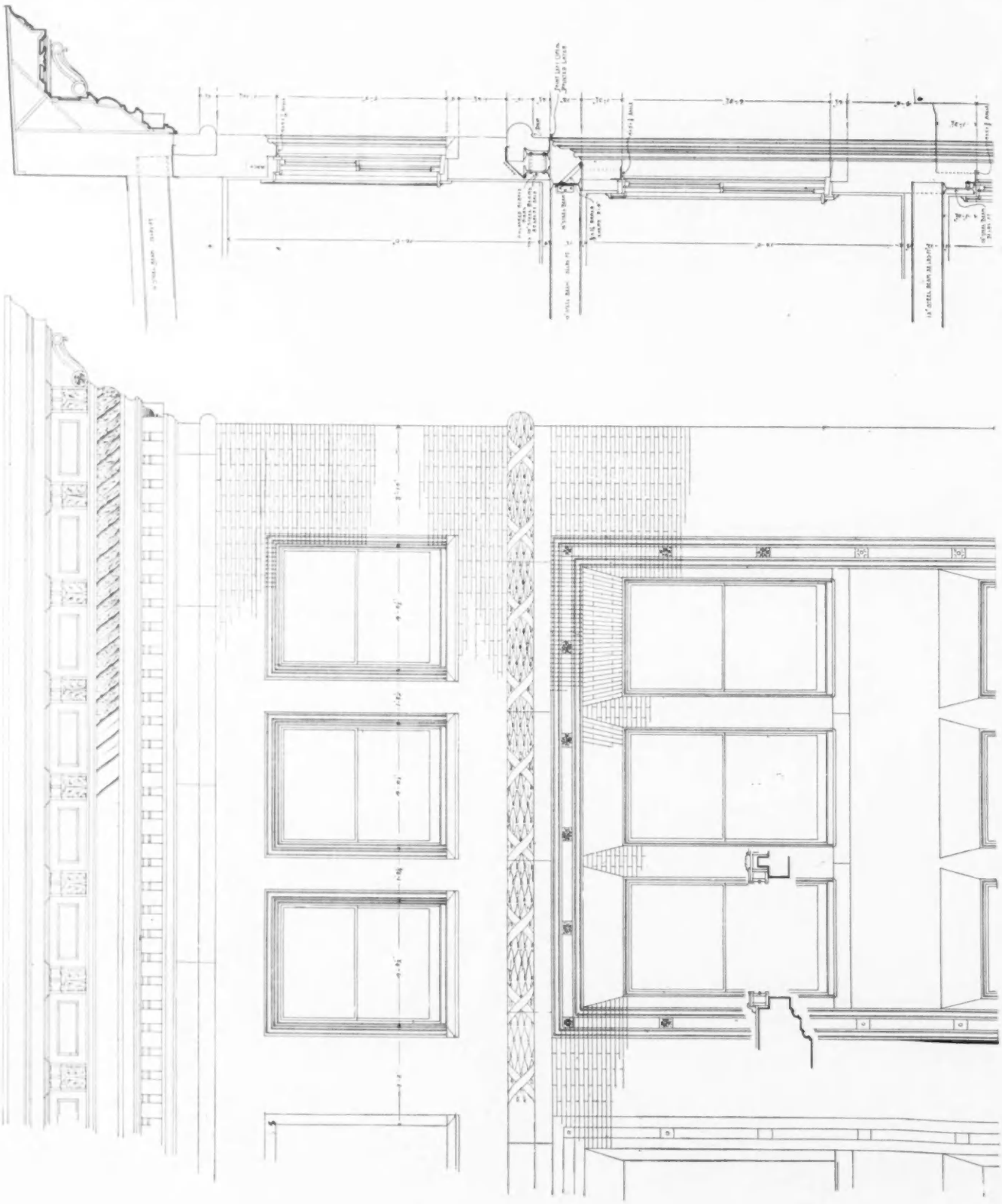
SAN ZENO MAGGIORE, VERONA.

SUPPLEMENTARY ILLUSTRATION TO "BRICK AND MARBLE IN THE MIDDLE AGES."

TEMPLE OF CONGREGATION KENESETH ISRAEL, BROAD ST. AND MONTGOMERY AVE., PHILADELPHIA.
LEWIS HICKMAN, ARCHITECT, BROWN BUILDING, PHILADELPHIA.
BUILT OF BUFF BRICK MADE BY THE EASTERN HYDRAULIC-PRESS BRICK COMPANY, PHILADELPHIA.



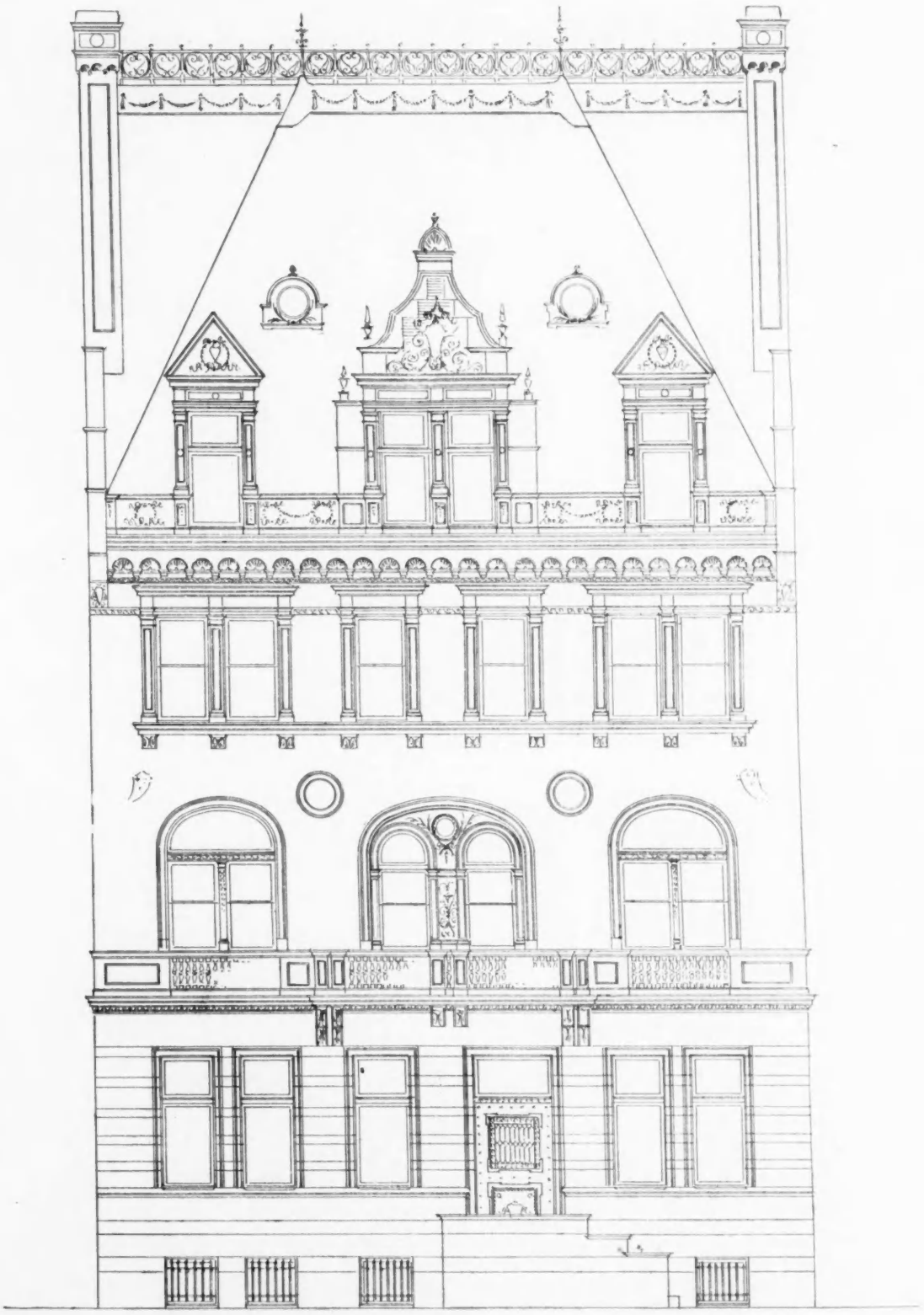
LIBRARY BUILDING FOR THE NEWTON THEOLOGICAL SEMINARY, NEWTON, MASS.
KENDALL & STEVENS, ARCHITECTS, BOSTON.
ENGLISH BUFF BRICK. TERRA-COTTA BY THE NEW JERSEY TERRA-COTTA COMPANY.



FRANCIS R. ALLEN, ARCHITECT, BOSTON.

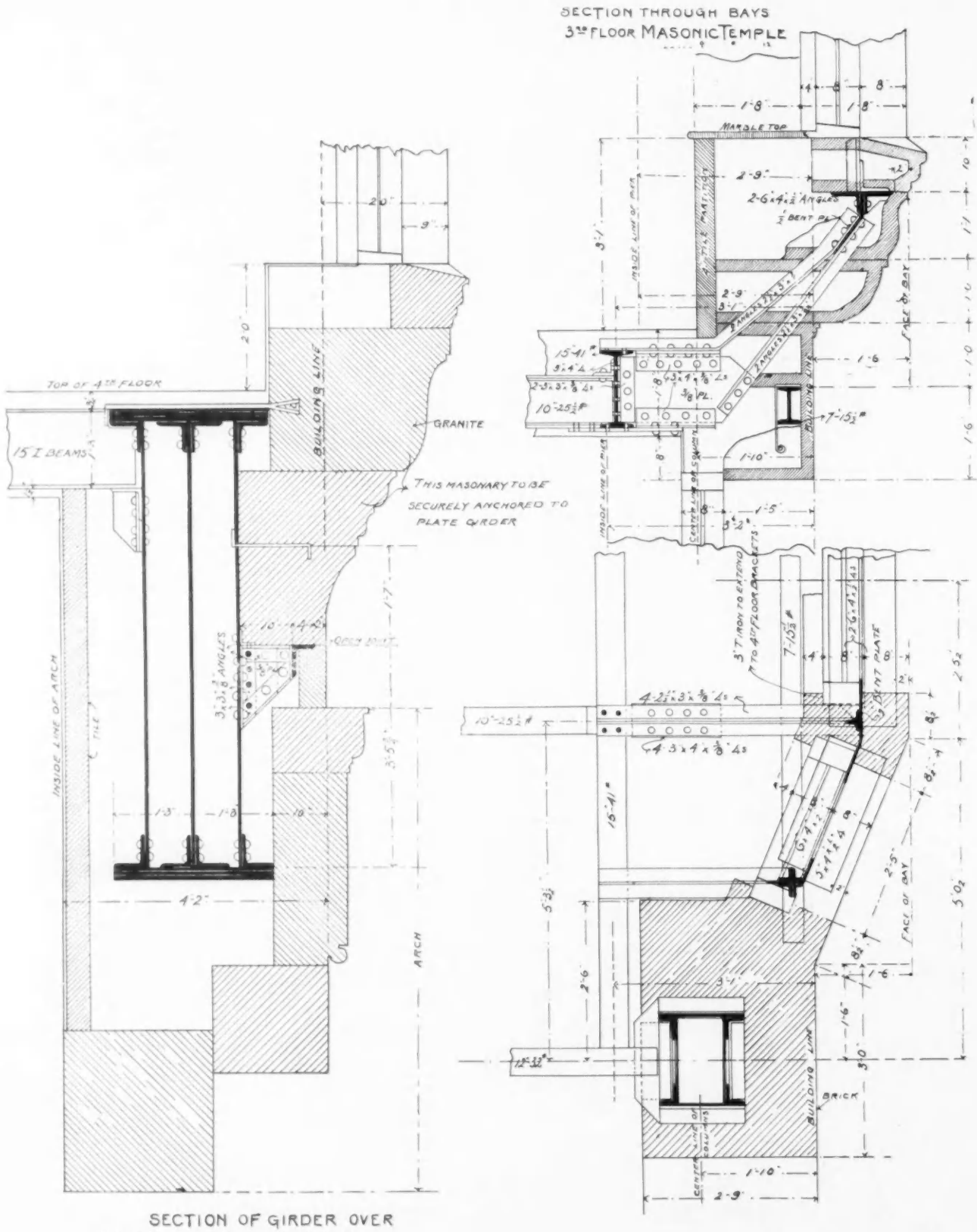
BANK BUILDING, PITTSFIELD, MASS.

DETAIL REDUCED TO ONE QUARTER INCH SCALE.

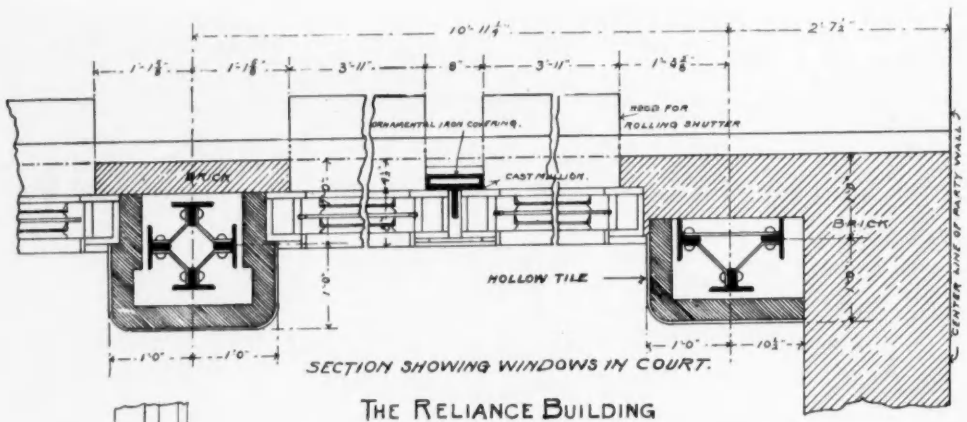


DESIGN SUBMITTED IN THE COMPETITION FOR A CITY HOUSE.

By J. G. Link, St. Louis.

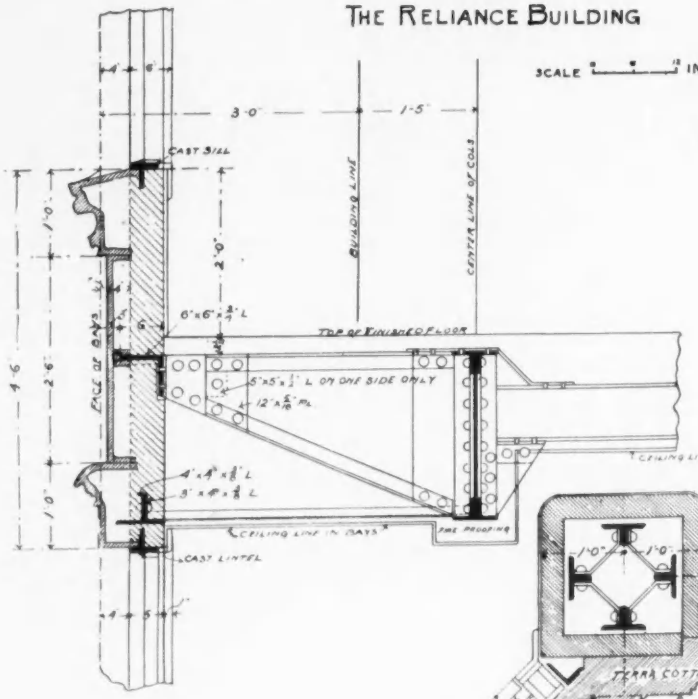


DETAILS OF FIREPROOF CONSTRUCTION.



SECTION SHOWING WINDOWS IN COURT.

THE RELIANCE BUILDING



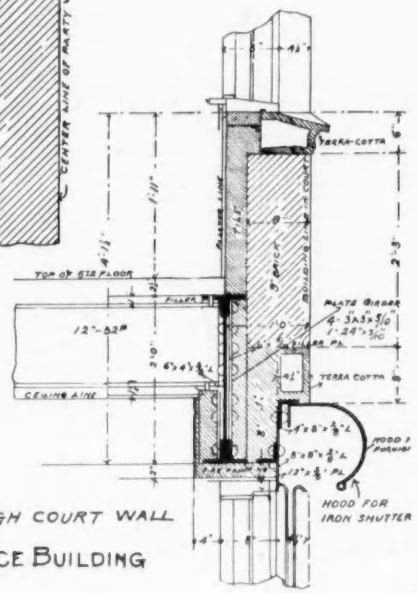
SECTION OF BRACKET THRO STATE ST. BAY

THE RELIANCE BUILDING

PLAN OF STATE ST. BAY

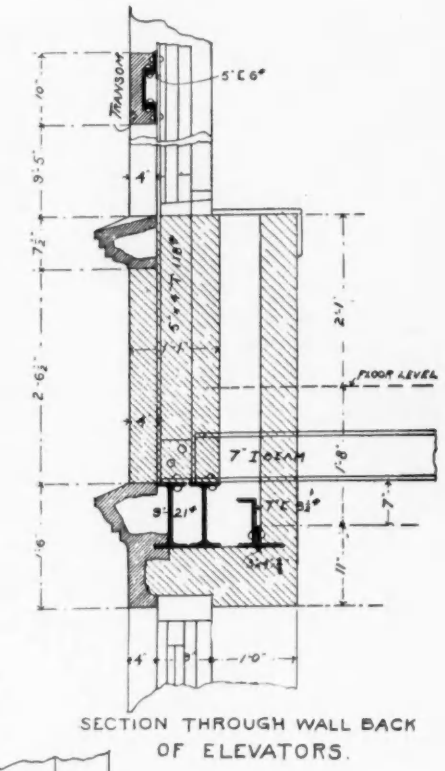
THE RELIANCE BUILDING.

SCALE

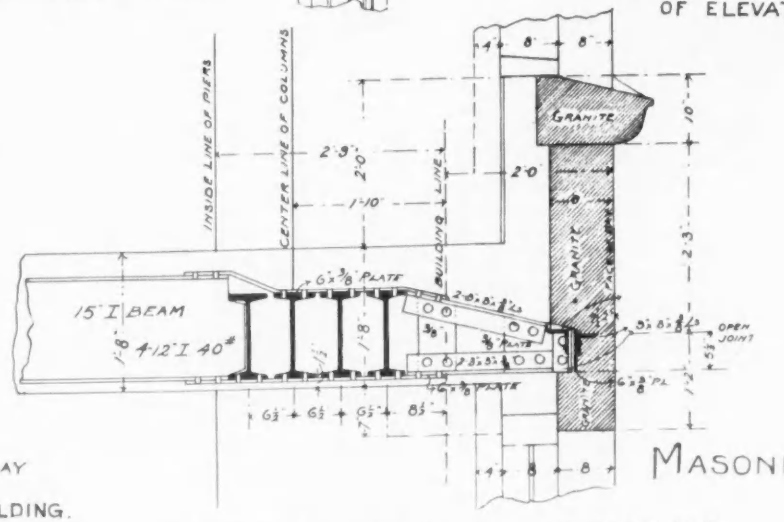


SECTION THROUGH COURT WALL

THE RELIANCE BUILDING

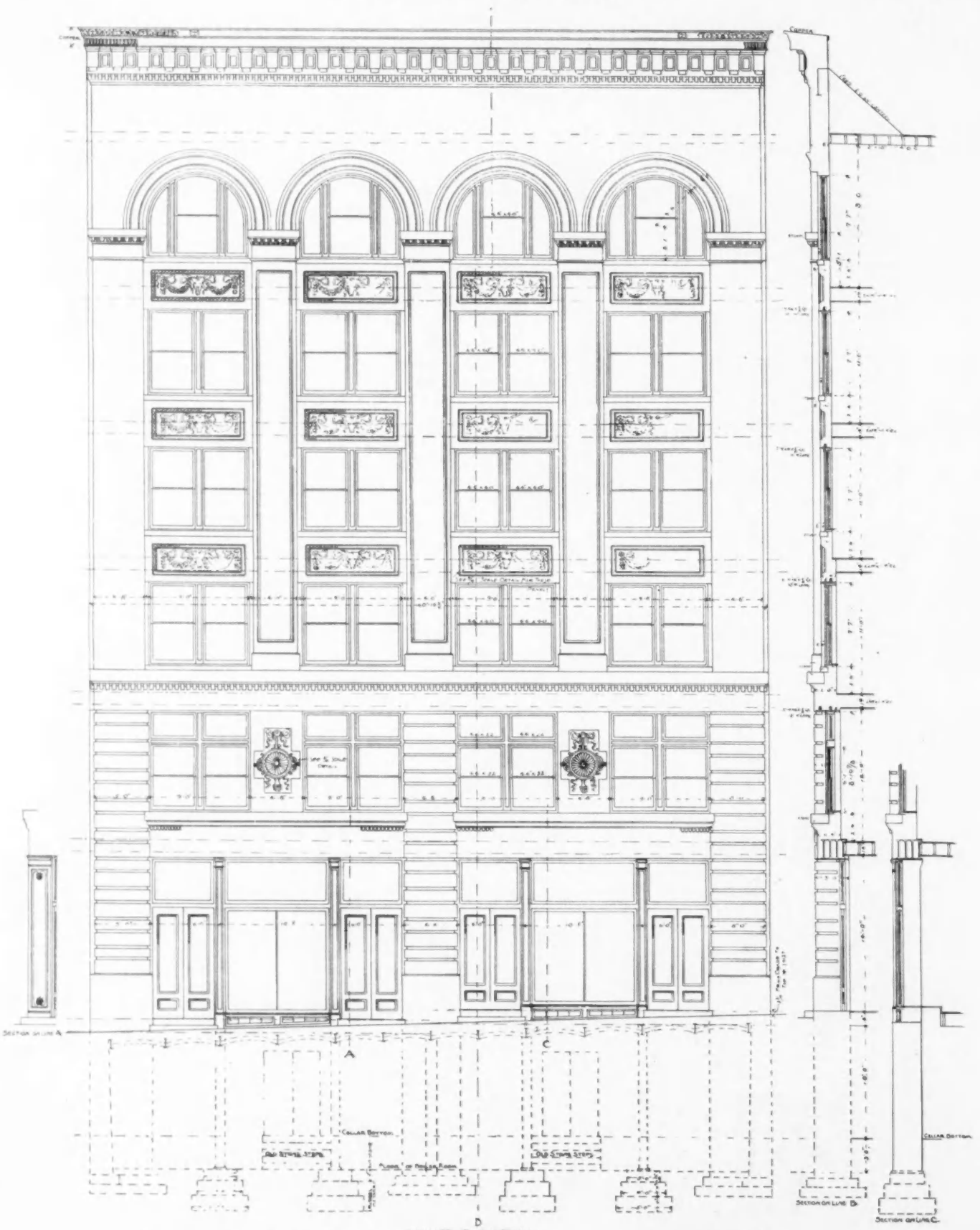


SECTION THROUGH WALL BACK OF ELEVATORS.



SECTION THROUGH CENTER BAY 4TH FLOOR

MASONIC TEMPLE.



GOLDWATER BROS.

FRONT ELEVATION
SCALE 1/4" = 1'-0"

BLACK & MEYER.
NOLAN, NOLAN & STERN,
ARCHITECTS.

STORE BUILDING, ROCHESTER, N. Y.

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

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PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

WE publish above a panel of white terra-cotta in the residence of Col. Wm. E. Rice at Albany, of which Richard Howland Hunt of New York is the architect. The work was executed by the Excelsior Terra-Cotta Co. of New York.

A FUND of two hundred pounds is being raised by the Royal Institute of British Architects for a series of systematic tests of brickwork, and this has brought out a number of descriptions of isolated tests made at various times and places, the last of which is particularly interesting, although it bears not so much on the crushing as the tensile strength of good brickwork.

The work in question was a part of the Albert Warehouses at Liverpool, and was of about fifty years' standing, consisting of hand-made bricks set with ground mortar of Halkyn Mountain lime, which is in a high degree hydraulic.

The brickwork was cut out, top and bottom, twelve feet wide, leaving a lintel seven courses deep (about two feet, the English brick being much larger than our standard size) and two feet wide, the ends being left in the wall. It was heavily loaded with no sign of defection. First two courses, and then one, were cut off, in order, and the ends cut out leaving a twelve-inch bearing on the original mortar bed.

The brick beam then measured four courses in depth, or about fourteen inches, the lower course being stretchers, the next headers, the third stretchers, and the fourth headers. A centre load of 9,500 pounds was placed on it and left several days with no apparent effect. This load was then increased to 12,923 pounds and was carried about thirty hours, when it suddenly broke, there being three fractures about eighteen inches apart in the middle of the lintel.

It is seldom that brickwork is submitted to such conditions, and the test is of value only as showing how homogeneous good brickwork may be made. An evenly distributed load would have made a more useful test, as indicating how near self-sustaining a wall over an iron or steel beam may be made. The old bricks in this wall could not be cleaned by simply tumbling the wall over and letting the shock shake the mortar loose.

TERRA-COTTA SPANDREL, AMERICAN THEATRE, NEW YORK.
C. C. HAIGHT, ARCHITECT.
NEW YORK ARCHITECTURAL TERRA-COTTA CO., MAKERS.

THERE still clings to a large portion of the Boston profession a deep-rooted prejudice against a dry-press brick. This is to a large extent unjust. Because once *all* brick made by this process may have been unfit for use, and now *some* brick are still bad, it does not follow that *all* dry-press brick are bad. There have been steady advances in the dry-press process which architects outside of Boston, and fully as capable of judging, take into consideration. St. Louis, the brick city of the United States, is largely built of dry-press brick; Chicago, Milwaukee, St. Paul, all with more trying climates than Boston, have many of their finest buildings of dry-press brick. Here is the mud brick stronghold; and while we are not championing dry-press methods in particular, we would suggest to the architects of Boston, many of whom can't now and never will be able to tell the difference between a mud and a dry-press brick, that there must be some enduring quality to entice so many hundreds of thousands of dollars, so much hard-headed business ability, so much mechanical genius, as we find enlisted in the dry-press brick industry. Look at our back cover, and at pages xiv and xx. Are such ponderous and at the same time delicately adjusted machines built for a song? Is there no study, no inventive genius, displayed in their mechanism? Could manufacturers afford to invest the capital necessary to bring out these machines, if the wares they produced were unfit for use? Then, too, take the dry-press brick makers themselves; are the men, for instance, who have the management of the enormous interests of the ten Hydraulic-Press brick companies of a visionary type? Can any one who knows Mr. Ittner imagine him chasing a will-o'-the-wisp? Are not these men (and a hundred others we could name), with their long experience in manipulating clays, with their opportunities to test brick, and with an interest in how their brick in one job, their competitors in another, are standing the test of time, an interest that is keen and lively, long after the architect himself has forgotten whether he used wood, brick, or stone, — are not these men, we ask, fully as capable of deciding on the value of a process of manufacturing as the architect who, comparatively, knows nothing whatever about it?

"ANENT the foregoing there is a tale," which is all the better because it is true.

A certain hustling salesman for a building materials house — the *one* that pastes paper labels on sample bricks — was preparing some samples to take to a prominent architect in New England. He knew this architect was down on dry-press brick and took, or thought he took, rather particular pains to fix up some very fine specimens of mud brick. The display room of the building materials house in question contains a large line of all shapes, colors, and kinds of brick, and in some way a dry-press brick got a mud-brick label, bearing the name of a firm known all over the country for their fine quality of mud brick. Our friend the salesman did not discover the mistake until later, when the architect had the brick in his hand and was remarking on its good quality. Then, with many apologies, he explained the mistake, and, *presto*, that brick lost all the good quality that the wrong label had made so apparent. As we said, this is true, and we would say to readers who may doubt it that, so far as the job is concerned, you are "warmer," as children playing hide and seek say, than you may imagine. While we do not say this was a Boston architect, he might as well have been. However, there are architects and architects, and, even in Boston, all are not indiscriminately condemning dry-press brick.

WITH this number, Chapter VI. of "Brick and Marble in the Middle Ages," begun in June, comes to an end. The whole chapter has been devoted to Verona, and twenty-eight illustrations have been given. Thirteen of these have been supplementary, being reproduced from photographs, six being full-page size. Previous to Chapter VI., there were twenty-two illustrations. The finest part of the work is yet to come, and we have in hand a large collection of the best photographs, with which to illustrate the text most fully. We would particularly call the attention of intending subscribers to the cities to be described and illustrated, of which we can only mention a few: Vicenza, Padua, Venice, Mantua, Cremona, Lodi, Pavia, Milan, Ferrara, Bologna, Modena, Parma, Piacenza, Asti, Monza, Como. There are in the original work eighty-seven illustrations remaining. To these we shall add from forty to fifty from photographs. This feature is alone enough to repay for subscribing, and we would urge placing an order to begin with the November number, when a new chapter will start. The interest this work has aroused has resulted in a demand for back numbers that has completely cleared our stock out, making it impossible to date subscriptions back any longer.

Starting with eleven illustrations in our January issue of this year, we have steadily increased the number, and not only that, but we have improved the average quality by more careful selection. Our last issue contained thirty-seven illustrations. Even should we not continue to increase the size of our paper and the number of illustrations, subscribers can count on this as an average; we do not propose to go backward, and we have no intention of standing still. Allowing for a very moderate increase, our illustrations for 1895 will number five hundred, and with original ariticles, correspondence from leading cities, a most valuable series of papers on fireproofing and on concrete construction, to round the volume out, it should be well worth our moderate subscription price.

TERRA-COTTA DETAIL, AMERICAN THEATRE, NEW YORK.
EXECUTED BY THE NEW YORK ARCHITECTURAL TERRA-COTTA CO.

FIREPROOFING.

A Department Conducted in the Interests of Building Construction to Prevent Loss by Fire.

FIRE IN MACINTYRE BUILDING.

ON Sunday afternoon, June 17, a fire occurred in the eighth floor of the MacIntyre Building, No. 874 Broadway, corner of 18th Street, New York. This building is constructed with a steel skeleton frame and steel beams filled in with hollow tile flat arches and hollow tile partitions manufactured by the Raritan Hollow and Porous Brick Company. The fire originated in the studio of Mr. R. Bier on the eighth floor directly opposite the offices of the Raritan Hollow and Porous Brick Company.

VIEW IN STUDIO, MACINTYRE BUILDING, NEW YORK.

Mr. Bier was engaged in cleaning some upholstered furniture and draperies with benzine in order to destroy moths; and after he had cleaned two or three chairs and saturated them pretty thoroughly with benzine, there was a sudden explosion and the fire seemed to jump from one article of furniture to another, and also communicated with the varnished woodwork of the doors and windows. The spread of the flames was so rapid that Mr. Bier was not able to open the door and attempted to get out of the window, but failed in this also. He was finally obliged to jump through the glass panel in the door.

He was very severely burned and cut, but rushed immediately down-stairs to the telephone office which is on the fourth floor, and from there an alarm of fire was sent out. By the time the firemen reached the building the room was a mass of flames, completely destroying everything in it. The fire was so hot that the iron steam pipes were melted and bent.

The studio had two doors and two windows opening into the hall. The fire spread through these and into the opposite rooms, the woodwork and doors of which were ignited.

The fire was put out before any serious damage was done to any of the offices except in the studio in which it originated, and in this room there was no injury done to the building itself except the woodwork and the plastering. The hollow tile ceiling and partitions were not injured in any way, and it merely required a new coat of plaster and new trim and wooden floor to put the office in complete order.

This fire clearly shows the great value of burned clay fireproof construction, the whole principle of which is to confine a fire to the room in which it originated.

Had such a fire occurred in a building of ordinary construction, the entire building would probably have been destroyed.

If this fire had occurred on a week-day when the employees of the building were about, it probably could have been put out with the fire hose with which the building is equipped, but having occurred on Sunday nothing was done until the firemen arrived, and it of course took them some time to get their hose up to the eighth floor. As it was they had the fire out inside of half an hour.

The photographs which were taken the following morning clearly show the effects of the fire on the tile partitions and ceiling, and also the condition of the room and hallways after the *débris* had been partially cleared up.

TERRA-COTTA IN SKELETON CONSTRUCTION.

(*Continued.*)

THE reader is referred to the article under above heading in preceding issues. Details are presented this month of the Chicago "Masonic Temple" and "Reliance" buildings, for the use of which thankful acknowledgment is made to Messrs. D. H. Burnham & Co., also a section through one of the numerous bays which form the front of the "Tacoma" building, —one of the pioneer office buildings, —for which we are indebted to Messrs. Holabird & Roche, the architects. In the "Tacoma" cast-iron columns and cast-iron lintels were

VIEW IN HALLWAY, MACINTYRE BUILDING, NEW YORK.

used. The mullions are special pressed brick, and the whole street fronts are thin shells of pressed brick and terra-cotta. Wind bracing was taken care of by means of heavy internal brick cross walls.

The "Reliance" building is under construction at the present time. The new "Gray" column was adopted for this structure. The chief claims made in favor of the "Gray" column seem to be, simplicity of construction, ease of designing connections, and consequent economy in time and expense of preparing shop drawings, continuous pipe space inside the columns, and economy of steel.

D. Everett Waid.

Editor of the Brickbuilder:

Sir, — In your issue of September I note an article upon Fireproofing City Houses, containing a comparative schedule of the fireproof and the non-fireproof structures, also a criticism, by Mr. Blackall, on Mr. Manley N. Cutter's original paper.

With pleasure I yield to Mr. Blackall as an architect, but I beg the privilege of disagreeing with him on some of his estimates of fireproofing. To say that it is most desirable in all cases to build fireproof is needless, as all thinking people concede this, the only impediment to such a universal result being the cost. It appears that there is no question but that the Chicago skeleton construction for large buildings is the cheapest, lightest, and best. For smaller buildings this perhaps is yet to be determined. As to party or partition walls, the building laws require solid brick walls, so that in this respect steel support and girders are apparently an extra expense. For outside walls, four-inch work is, as Mr. Blackall says, entirely too thin, and no method is provided for bonding, or tying the same to make it secure; but with a single course of brick outside, and a six-inch partition block inside, it would be possible to have a bond at regular intervals, which would insure security, and this block would cost eighteen cents per square foot laid and ready for plaster, the whole independent of iron. Mr. Blackall figures brickwork at thirty cents per square foot, and with iron at forty-two cents, which is eight cents less than the cost of a sixteen-inch wall at his figure of fifty cents per square foot, and only four and one half cents more per square foot than for a twelve-inch wall. Now to this item of thirty-seven and one half cents per square foot for twelve-inch work, or fifty cents for a sixteen-inch wall, it seems evident some addition must be made for plastering, this apparently having been omitted. It would not seem wise to apply the mortar directly to the outside wall, unless the same were either furred and lathed, or vaulted, as no way has been provided to prevent the dampness from penetrating the wall, — quite an essential consideration. The expense of vaulting need not be computed, as it appears sufficiently positive that it would greatly increase the difference shown between the two methods, to say nothing of the loss of room used in this construction.

To fur and lath the cost would be, for furring, three inches wide, twelve inches on centres, at $20 per thousand feet, including spikes, one half cent per foot; for labor in applying same, at $2.50 per square of one hundred square feet, two and one half cents per foot; and for wire lath three cents per square foot, which is the cost for suspended ceiling, making a total of six cents per square foot; which would bring the cost of the twelve-inch wall up to forty-three and one half cents, and of the sixteen-inch wall up to fifty-six cents, ready to plaster, thus giving the benefit in both cases to the new methods, and in neither case is the five-inch or nine-inch loss of room calculated, or the expense of land for same or the interest.

Again, taking the figures for floors, as given for iron work, concrete, and suspended ceiling at forty-three cents per foot, we find numerous items missing. In the cost of the timbered floor no labor has been provided for putting the flooring in position and framing same, furring the ceiling for lathing, or the wire lath for same. This would cost for labor, framing, and putting the floors in position, $5 per square, or five cents per foot; furring and labor, as before estimated, three cents; and wire lathing at three cents per square foot as for suspended ceiling, a total of eleven cents, to which add the four cents, as given for flooring, bringing the cost up to fifteen cents per square foot. Here is fully twenty-five per cent addition to the difference between the old and new methods, really giving a fireproof building, in the matter of walls and floors, for an additional expense of twenty-eight cents per square foot over that of an inflammable structure.

While in this we have diverged slightly from the lines laid down in the comparison of Mr. Blackall's and Mr. Cutter's methods of exterior walls, we have added to the expense of the terra-cotta blocks, making the same six inches instead of four inches, but the additional expense of the wire lath is in this method dispensed with, and a strong, stable, and secure wall is produced without the aid of any foreign auxiliary strengthener, that appears by its separating the different courses of brick to take from the strength by effectually preventing a tie, except from the mortar.

We heartily concur with Mr. Blackall "that this is an attempt in the right direction," but many suggestions may be made to get a far better result and at the same time diminish the cost considerably. For instance, an eight-inch flat terra-cotta arch could be used at no additional expense, and save the three cents per foot for wire lath, bringing the difference to twenty-five cents per square foot over that of the common combustible method.

In both these articles it will be remarked that no notice is taken of any differences other than cost, while the many advantages not directly pertaining to expense are totally ignored; as, for instance, deafening, drafts, vermin, temperature, durability, strength, insurance, etc. We hope some one will show the money-saving advantage of fireproof construction, and eliminate this money difference, which really does not exist when dollars and cents are placed opposite each advantage, in comparison with the old methods.

H. H. Fernald.

Boston, Oct. 10, 1894.

For the details of Fireproof Construction see Plates 78 and 79.

MORTARS AND CONCRETES.

A Department devoted to Advanced Methods of using CEMENTS and LIMES in Building Construction.

A REVIEW OF VARIOUS METHODS OF CONCRETE CONSTRUCTION AS APPLIED IN ENGINEERING WORKS.

CONCRETE IN FOUNDATIONS.

CONCRETE has shown itself to be so satisfactory for foundations of all kinds, that it has come to displace, almost wholly, all other building material in this department of construction. In submarine works it is indispensable. In wet localities, in newly made ground, under tide water, on marshy and springy earth, it forms the best of footings, and when combined with steel, it has become well-nigh indispensable for distributing heavy concentrated loads over large areas, as in the great Chicago buildings. Its massiveness, strength, imperviousness, and ease of manipulation have made it deservedly popular in heavy masonry construction of all kinds.

For moderate loads, say for a five or six story brick tenement, a very substantial footing is formed by laying a mass of concrete in rough wooden moulds. The base should be about three feet wide, although this depends wholly on the nature of the soil upon which the building rests. The thickness should not be less than two and one half feet, if the soil is at all springy. The sides should be sloped up at an angle of about 60°. Such a foundation is suitable on newly made ground that is springy and constantly wet by tide water. It is better than piling, for the reason that it gives a more uniform settlement, is free from shocks and the consequent danger to neighboring property, and besides is less expensive.

The concrete should be made in the proportion of about one barrel of high-grade Portland cement to a yard of aggregates. Large stone, of angular fracture, broken to pass a two-inch ring, should be used with a liberal quantity of coarse, sharp, gravelly sand. It should be borne in mind that about one half of a cubic yard of gravelly sand may be mixed with a yard of coarse stone, without increasing the bulk of the stone. By aggregates, is meant a mixture of stone and sand in such proportions as to fill all the voids and make a compact mass.

The concrete should be thoroughly mixed, and wet sufficiently to bring it to a stiff viscous condition. The moulds should be formed of rough spruce stock, rigidly braced, so as not to vibrate when the tamping is being done. The concrete should be put in in layers of about six inches thickness, and well tamped, and layer should follow layer until the mould is filled. Such a foundation forms a solid monolithic block of great strength and stiffness, and the ease and rapidity with which it may be constructed are great points in its favor.

For heavier loads, and in those localities where the supporting soil is poor and uncertain, it is often advisable to increase the rigidity of the concrete by the use of iron. In the great Chicago buildings, where the soil supports barely one and one half tons to the foot, these iron and concrete foundations are constructed on a very large scale. Layers of large rolled beams imbedded in concrete are laid one upon the other crossways, and in this way a great concentrated load is distributed over a large area. The object of the steel beams is to give sufficient stiffness and resistance to bending to the concrete to enable it to distribute its load.

In place of the rolled beams, a method has been largely used which gives the same results at a great saving in cost. This is accomplished by using rods of twisted steel, and imbedding them in the concrete in such a way that if there is any unequal settlement of the soil the iron will prevent any bending and consequent cracking of the foundation.

In an article by Mr. F. E. Kidder, the well-known author of the "Architect's Handbook," published in *Architecture and Building*, a description of these twisted steel foundations is given, and is interesting reading: —

"Concrete, as is well known, offers a great resistance to compression; but as its tensile strength averages only about one twenty-fifth of its strength to resist compression, it has but little transverse strength. It has been sufficiently proven, however, that the tensile strength may be made equal to the resistance to compression by imbedding twisted iron bars, bands, or hoops near the bottom of the concrete, or in that portion which is in tension. In this way concrete may be made to sustain great transverse loads, and this mode of construction has been used quite extensively in California.

"In building the footings with steel beams the strength of the concrete is practically wasted, while in this method of construction it is all utilized. It has been proved that the entire tensile strength of the twisted bars can be utilized, and being held continuously along their entire length by the concrete, as a screw bolt is held by the nut, they neither draw nor stretch, except as the concrete extends with them.

"In building concrete footings, a layer of concrete from three to six inches thick, made in the proportion of one to three, should first be laid, and the iron bars laid on and tamped down into it. Another layer of four inches, mixed in the same proportion, should then be laid, after which the concrete may be mixed in the proportion of one to six. Each layer should be laid before the preceding layer has had time to harden, otherwise they may not adhere thoroughly.

TABLE III.

Proportions and Strength of Concrete Footings with Twisted Iron Tension Bars.

WIDTH OF FOOTING IN FEET.	THICKNESS OF CONCRETE.	WIDTH OF STONE FOOTING	DIST. BETWEEN CENTRES OF BARS.	SIZE OF SQUARE BAR.	SAFE LOAD PER LINEAL FOOT.	SIZE OF SQUARE BAR.	SAFE LOAD PER LINEAL FOOT.
	Ft. In.	Ft. In.	Inches.	Inches.	Tons.	Inches.	Tons.
20	3 6	6 0	8	2	78	1 7/8	63
18	3 3	5 6	8	2	76	1 3/4	56
16	2 10	5 0	7	1 3/4	73	1 5/8	50
14	2 8	4 8	7	1 5/8	70	1 1/2	49
12	2 6	4 4	6	1 5/8	65	1 1/4	48
10	2 3	4 0	6	1 1/4	65	1	42
8	2 0	4 0	6	1	60	3/4	40
6	1 8	3 6	6	3/4	55	1/2	29

"The writer has prepared Table III., giving the strength and proportions of footings constructed in this way, which he believes to have a large margin of safety. Two sizes of bars are given, with the corresponding safe loads for the footings, the other measurements applying to both cases. The measurements in the third column refer to the width of the brick or stone footing resting on the concrete. The greater the width of this footing in proportion to the width of the concrete, the less will be the strain on the tension rods.

"*Piers.* — Footings for piers may be built in the same manner, with two sets of bars laid crossways of each other, and also diagonally. In the case of piers, the corners should be cut off at an angle of 45°. The same size of bars should be used for a pier as for a wall, whose footings have the same projection beyond the masonry, and the depth of the concrete should be the same."

This principle may be very advantageously followed in light foundation work. The thickness of the concrete may readily be reduced from thirty-six inches to fifteen inches, with great saving in cost. The width of the footing is determined by the character of the soil. The thickness depends on the load, the iron and concrete areas being properly proportioned one to another, assuming that there should be about one hundred and fifty times the area of the iron in the area of concrete; that is, if the area of iron required to provide the necessary strength to the concrete to tensile strains is one square inch, the area of concrete used in that section should be at least one hundred and fifty square inches.

A building bearing on soil capable of sustaining three tons per square foot, with a load of say ten tons to the linear foot of wall, would require a concrete foundation about three feet four inches wide and sixteen inches thick, with three three-quarter inch rods set three inches from the bottom, twelve inches on centres.

R. F. TUCKER.

AMERICAN PORTLAND CEMENT.

EDITOR OF THE BRICKBUILDER:

Sir, — In looking over the articles in your paper on cement and cement work for the past two months, one cannot help wondering how long creditable journals propose to publish articles which tend to destroy confidence in the product of an important American industry without first finding out whether the writer is sufficiently versed to treat the subject fairly. In Mr. R. F. Tucker's paper in your August number we find the following: —

"The German Portlands are the finest in the world in all respects, and an engineer may be at ease when his work is being done with these standard cements. . . . The Portland cements of American manufacture have a long road to travel before reaching the standard of excellence achieved by our rivals across the water. . . . The writer is not aware of the existence of a cement plant in the United States in which the production is carried on precisely as in Europe, nor is the term 'Portland' justly assumed by a great majority of American cements."

Mr. Tucker before writing certainly could not have made himself acquainted with the existing facts relative to the manufacture of cements in France, Denmark, and the United States.

There has been some low-grade Portland cement made in this country, owing to the fact that there was a market for it, but the manufacturers have always found that they could not compete with the English and Belgian factories for this trade, so have usually manufactured the highest grade of material, which brings in the New York, Philadelphia, and Baltimore markets from ten to thirty cents per barrel more than the highest priced English and Belgian brands. The reason the high-grade American cements command this advance in price is because they are equal in quality to the French, Danish, and German Portlands, and enter largely into competition with them for the best grade of work.

In a paper read before the members of the American Society of Civil Engineers, Nov. 7, 1877, by Capt. W. W. McClay, we find the following: —

"About two years ago, in preparing the specifications for a large quantity of Portland cement to be delivered in this city, the writer, in the test for fineness, required that at least eighty-five per cent of the cement should pass through a sieve containing twenty-five hundred meshes per square inch, that the weight of the struck bushel should not be less than one hundred and fifteen pounds, and the tensile strength, for the seven days' test, at least two hundred and fifty pounds per square inch. Several English manufacturers applied to by the importers to fill this contract declined, except for unusually high prices, alleging that the cement as ordinarily burnt, if ground to the degree of fineness required, would not come up to the weight required per struck bushel, and that in consequence of the extra burning producing a harder material to grind, much unnecessary expense would be entailed upon them. The cement was eventually supplied by the Burham Company at the ordinary market price, and although passing the test for fineness, never came quite up to the standard required in the weight per struck bushel.

"In contrast to this may be mentioned the recent experience of the writer with the Coplay Cement Manufacturing Company in supplying the Saylors American Portland cement under a contract in which the test for fineness only required that eighty per cent of the cement should pass through a sieve with twenty-five hundred meshes per square inch, that the weight of the struck bushel should not be less than one hundred and ten pounds, and that the tensile strength per square inch at the end of seven days should be two hundred and fifty pounds; or in other words, a lower standard of fineness and weight than in the contract above alluded to, which was filled by the Burham Company. When this American Portland cement was supplied on the work, it was found to exceed considerably the requirements of the three tests, averaging over one hundred and twenty pounds per struck bushel, over two hundred and fifty pounds per square inch in tensile strength, and over ninety per cent passing through a sieve containing twenty-five hundred meshes to the square inch."

It will be seen by the above account that as far back as 1877, before practically any German cements were sent to this country, the Coplay Cement Company was making Portland cement that would fill the strictest specifications then in use; and as the standard of excellency advanced in Germany under careful investigation, so it advanced in the works located in Lehigh County, Pa., until last fall when Messrs. Cope & Stewardson of this city placed plans and specifications on the market for a large building to be erected at 10th and Filbert Streets, Philadelphia, the specifications calling for a concrete foundation made with a Portland cement of either American or foreign manufacture that would show a fineness of

100% to pass a sieve with 5,800 meshes per square inch.
95% " " " " " 10,000 " " " "
75% " " " " " 40,000 " " " "

A tensile strength of

450 lbs. neat in 7 days, 1 inch briquette.
600 " " " 28 " 1 " "
125 " 3 sand " 7 " 1 " "
200 " 3 " " 28 " 1 " "

The Coplay Cement Company was the only bidder on the cement, and we were informed by the contractors, Messrs. F. M. Harris & Co., of Philadelphia, that they could not get an importer of a German brand to guarantee his cement to meet these specifications for fineness. Five thousand barrels of "Saylors American Portland cement" were used on this work, all of which successfully passed the tests. Cases of this kind and the one Mr. McClay cites in his paper are of frequent occurrence. The St. Louis Water Works has used large quantities of the best known German cements and some American Portlands for several years passed, but this year the specifications call exclusively for cement of American make, with the same requirements as they previously had when they used foreign cement, and it is well known that they had plenty of bidders, the contract being awarded to one of the works in Lehigh County, Pa.

If Mr. Tucker, or any other party who is willing to investigate American Portland cement, will take a trip to Coplay, Lehigh County, Pa., he will find a mill making Portland cement precisely as it is made in all the leading factories in Germany; in fact, he would not have to go very far from Coplay to find several such works, some of which have placed tons and tons of their product in the most important engineering structures built in this country during the past fifteen or twenty years; and after making this trip, if he would then visit many of the leading works in England, he would find, instead of the well-built buildings, the most improved labor-saving machinery, and the nicely fitted up laboratories where the manufacture is carefully watched in all its stages (which he saw at Coplay), a lot of old sheds, with little or no care being taken to insure a perfect mixing or burning of the composition. Crossing over the channel to the Societe Anonyme des Ciments Français works at Boulogne-Ser-Mer, France, and on to the great German works of F. O. Alsen & Co., H. Manske & Co., and Dyckerhoff & Son, and not until arriving at the Aalborg Portland Cement Works at Aalborg, Den., would he find anything that would surpass what he saw in the Coplay region. The works at Aalborg are as near perfect and make as near a perfect Portland cement as the consummated skill and experience of the leading chemists and engineers of Europe can produce. A mill of the same description, with the addition of a few American labor-saving appliances, is now being erected at Coplay, Pa., by the Coplay Cement Company, as an addition to their already large plant.

Anybody at all conversant with the process of manufacture in the leading works in Germany and America knows by Mr. Tucker's remarks that he has either never seen cement made in these factories, or else when in the mills did not know enough about cement manufacturing to see the process of making the product was the same, but unfortunately very few of the readers of Mr. Tucker's article have ever examined the mode of manufacture in Europe or America, and have not to any large extent made careful comparison between the best product of the American and that of the foreign, so they do not un-

derstand the injustice Mr. Tucker has done the American Portland cement.

In reference to the misuse of the term "Portland," we personally do not know of a brand of American Portland cement that comes in competition with us but what is a true Portland cement in every sense of the word, and we feel that it is high time that such public criticism of the American Portland cement industry should cease.

Yours respectfully,

WM. G. HARTRANFT,

Vice-President Commercial Wood and Cement Company.

IN REPLY TO MR. HARTRANFT AND MR. NEWBERRY.

THE criticism of the writer's articles on Portland cements calls for some comment, although the arguments presented are not in the least conclusive.

Does the manufacturer imagine that his is the only voice that should be heard? Has the consumer no option as to the brands of cement he is to use? Has he no right to express his views upon a subject upon which perhaps his reputation and his fortune wholly depend?

There has been no wholesale condemnation of the American product. The writer is well aware that some American manufacturers can produce a cement equal, nay superior, to the foreign article in strength and firmness. He knows well enough that many works of great importance have been built wholly of domestic cements, and fulfilled very rigid specification. He knows well enough that when certain manufacturers start in to produce a given grade of cement for a given contract that they can do it; but when he goes into the open market to buy a dozen or a hundred barrels of cement for a certain piece of work, why is it that he does not call for American brands? Is it prejudice? Other things being equal, is there any reason for preferring the German or the Danish or the French or any other foreign brand? But every consumer knows and every manufacturer knows that we don't go into the open market and buy American Portlands when important work is to be done. We use it only when it is furnished direct and with special care; and when the writer says that the American brands have a long road to travel, he means precisely that the uncertainty has been caused perhaps by more or less unfortunate experiences; but surely, reputable journals who desire to represent both sides of an argument will publish the consumers' side as well as the manufacturers'. The readers of these articles are intelligent people, and they know that American cement of the highest quality is produced and that they can buy it, but they are not going to do it without taking proper precautions.

Manufacturers who are as careful as Messrs. Manske & Co. or Messrs. Dyckerhoff & Co. and others to send out cement only of excellent quality need not fear for the future, because we believe that the American cement will always be preferred, all conditions being equal. A specimen of an imported cement was recently taken at random from a number of barrels furnished to a certain contractor, and at the end of twenty-four days the testing machine failed to break a one-inch square section at one thousand pounds. When American cements are produced of such uniformity that the consumer may be certain of its work, then the criticism of domestic cements will cease; but while there is danger of irregularity in any particular brand, that particular brand is going to be used with caution. No one is more interested in the American cements or desires to see them succeed more than the writer, and when he is assured that the results achieved by the use of any brands of American cement taken as they come will be as satisfactory as those obtained with foreign brands, the writer, as a consumer, is ready to give the American brand a wide preference.

ROSS F. TUCKER.

A CORRECTION.

IN the July number an article on Mortar Colors contained the statement that in using "hematite red" it was necessary to allow fifty or sixty pounds to a thousand brick. Mr. F. DeW. Smyth, the treasurer of the Clinton Metallic Paint Company, who manufacture this brand, writes us that this is too liberal an allowance, and that the actual amount needed is never over forty-five pounds, and if properly used thirty-five pounds should suffice. In recognition of the full strength of this color, we make the correction.

THE MASON CONTRACTOR.

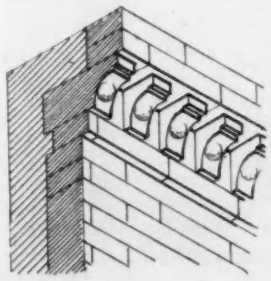
A Department conducted in the interests of the Builder, and the Contractor for Brickwork.

INTRODUCTION.

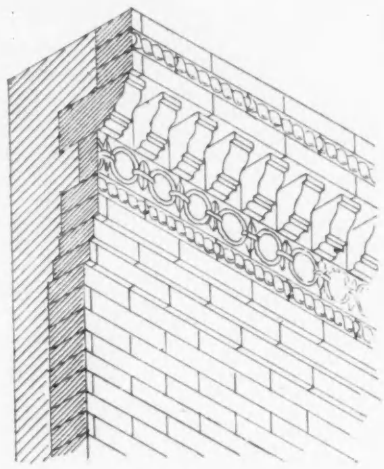
IT is our purpose, in establishing this regular department, to endeavor to make it of great practical value to thousands of contractors and builders, particularly in the matter of designs for all decorative features of buildings, such as cornices, chimney-tops, belt courses, arches, panels, etc., etc., showing these by drawings that will be a sufficient guide for the execution of the work. It is not our purpose to supplant the architect in any way. We believe that no building should be done without his professional service; yet we recognize that there are thousands of the smaller towns where, at the present time, his services are not available except for the most important work, in which case an architect in some city, perhaps far distant, is engaged. In these towns a builder must also be architect; and while the general plan and design of the building are worked out in consultation with the owner, the builder is thrown upon his own resources for the designs of details. To be of assistance in this is the chief aim in establishing this department. In it we shall publish a large number of designs for such details, and also some designs for entire buildings of the smaller and more common type, particularly cottages, stores, and schoolhouses. We shall endeavor to make the department, also, a bureau of information on subjects connected with practical building, and, as we have a large staff of competent writers in all parts of the country, we feel certain we can answer any reasonable question. This staff is composed almost entirely of men engaged in actual contracting, who hold themselves ready to write upon any special subject for which they think their experience fits them. We solicit a trial subscription from every builder, and would also be glad to receive suggestions for the improvement of this part of THE BRICKBUILDER.

CORNICES OF PRESSED AND ORNAMENTAL BRICK.

THE two cornices here illustrated by isometric view are best executed in smooth, regular brick, of even color, for two reasons: first, they should be laid evenly, which is impossible with brick of untrue shape and varying size; and second, the details are so small in scale that all difference in local coloring should be avoided. It is a mistake to execute decorative brickwork in strongly mottled or variegated brick. In this work the design is brought out by light and shade. A course is projected an inch in order to produce a horizontal line by the shadow it casts. A row of dentils counts only when the projecting faces are in full light, the reveals in full shadow. A piece of decorative brickwork needs the strongest sunlight from the right direction to overpower even moderate differences in the color of the brick; but when seen in ordinary light, difference in color competes with and destroys the light and shade effect. For example, in a dentil course certain projecting bricks may be dark, recessed bricks light, the difference being greater than the light and shade. The one neutralizes the other, and there is a break in the course. Occasional breaks may in some instances lend charm to detail, just as in some of the colored marble work of Italy a master hand has put in, here and there, a bit of color in contrast to the general scheme to break the monotony, but the danger of discord is far greater than the danger of monotony. But to return to our subject.



The small cornice may be used for a brick porch, a bay-window, or some portion of a building which needs a small cornice, or it may be used for a belt course, in which case it would only count for five courses, or about a foot. Taking a brick 2⅜ x 8¼ x 4½ at $25, and for the ornamental brick, Ittner's 33, for instance, at eight cents each, the stock for this cornice would cost from thirty-eight to forty cents per running foot.



The larger cornice will answer for a building of very respectable size. It contains three patterns of ornamental brick, and Mr. Ittner's calalogue being the only one at hand at this writing we will select from that. For the rope moulding, No. 88 is satisfactory, and costs eight cents: No. 22 or 23 at five and one half cents will answer for the dentil or bracket course, though these are not exactly like the design. For the five-inch course, No. 139 will go, though this is double-size brick and rather expensive, costing twelve cents. At these figures the stock will cost very close to eighty cents per lineal foot, in first-quality red pressed brick, the face work, of course, only being estimated. For the five-inch course a number of other patterns could be substituted, as, for example, to again quote from Ittner's catalogue, 110, 111, 113, 114, and 120.

GEOMETRICAL PATTERNS IN BRICKWORK.

I.

AMERICAN BOND WITH TWO COLORS.

THE value of brick as a material for ornamenting flat surfaces with geometrical designs has been recognized in every brick-building period and country. Italy, Spain, and France contain many beautiful examples of such work, while much of the more recent work in England depends to a considerable degree upon the architectural effect of diaper patterns. In this series of articles it will be the aim to present a number of patterns, from the simplest to the most complex, in each of the principal bonds used in brickwork, and to give a number of examples for their use, in a variety of ways.

The simplest and most common bond is the so-called "American," consisting of courses of stretchers, evenly breaking joint. This is not properly a bond, though it is called so, as it depends upon metal ties or upon bricks set diagonally across the wall, one corner fitting into a V cut out of the backs of the front brick. The patterns formed with it are not so interesting as those of the other bonds, but there are many instances where it can be used to advantage, and some of these will be pointed out in these articles.

To get any effect whatever with this bond it is evident that two colors of brick must be used, as the mortar joints give no character to the work. In fact for any effect in diaper patterns two and sometimes three colors are necessary. These need not be contrasting colors, and often it is best they should not be; two shades of one color are sufficient, or even two *textures* of identical color. A light red smoothly pressed brick with a dark red brick a very little rougher

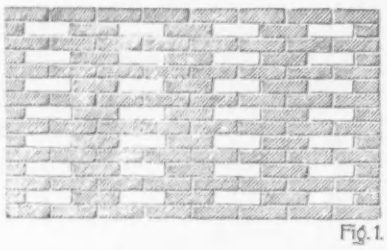


Fig. 1.

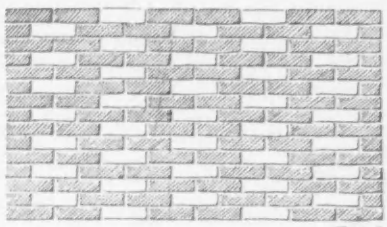


Fig. 2.

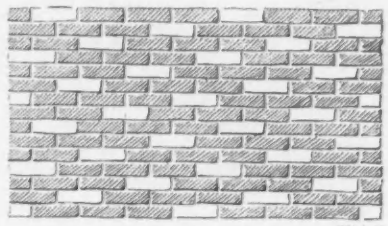


Fig. 3.

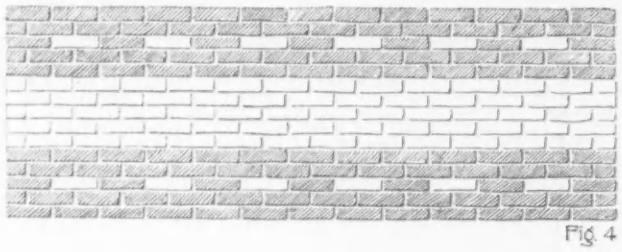


Fig. 4.

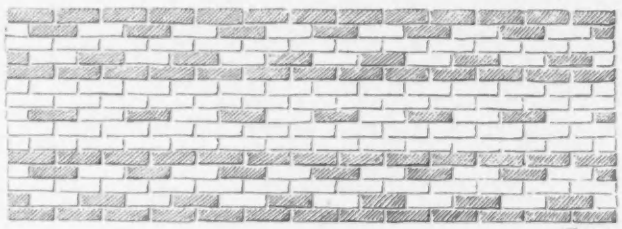


Fig. 5.

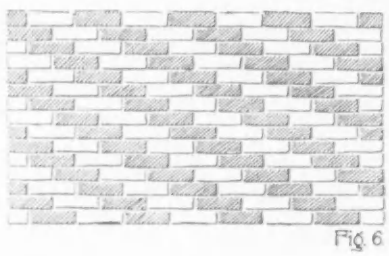


Fig. 6.

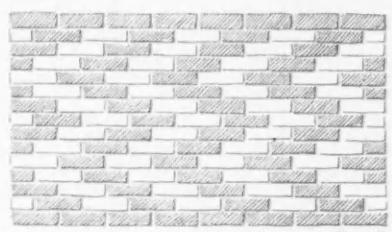


Fig. 7.

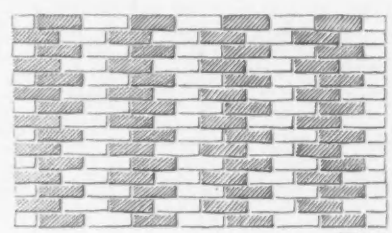


Fig. 8.

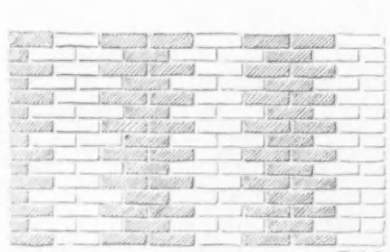


Fig. 9.

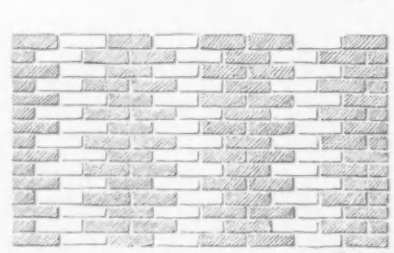


Fig. 10.

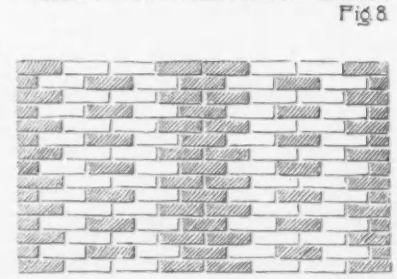


Fig. 11.

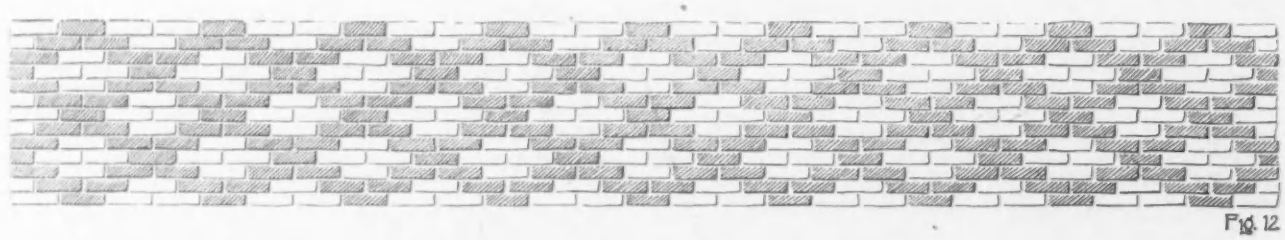


Fig. 12.

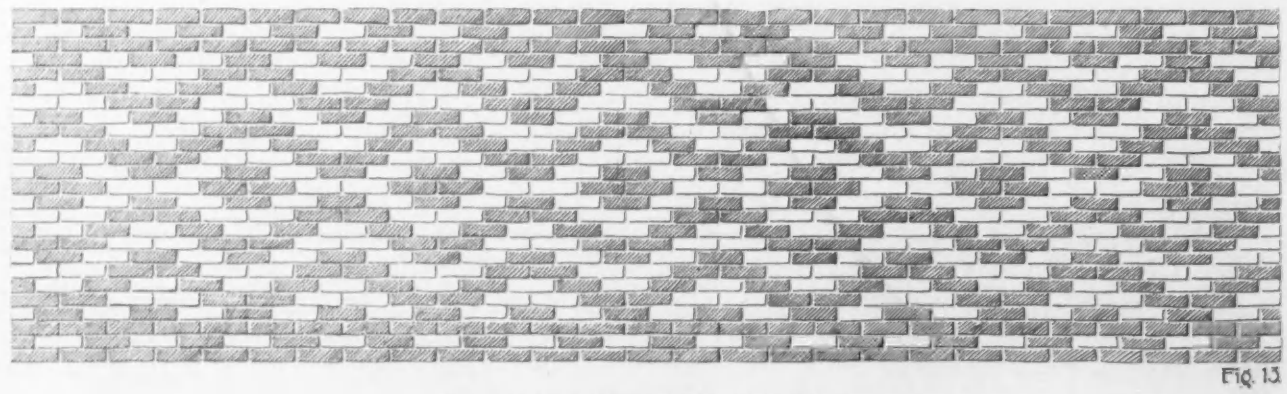


Fig. 13.

MOTIVE FOR DECORATIVE BRICKWORK.

in texture will give the most pronounced contrast. A red and black, a red and buff, a red and gray, will all make good combinations, especially in common brick.

On the opposite page are grouped a number of the simpler patterns, good for "all over" designs as they are called, that is, for unlimited surfaces.

Fig. 1 is one of the simplest courses of one color alternating with courses made up of brick of both colors, these being laid alternately in the course. In Fig. 2 this is varied slightly by laying two dark and a light in a course, repeating this, and placing the light in one course to bond with the two dark brick in the course below. Fig. 3 shows a still further variation obtained by laying three dark and one light, placing the light to bond with the first two dark of the course below.

In Figs. 4 and 5 are shown two motives that cover a surface with alternating bands or stripes. These can also be used alone as they are shown in the plate, for low walls.

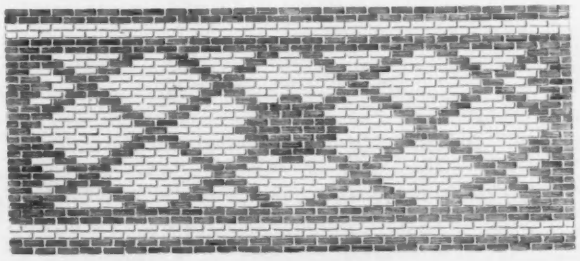
Fig. 6 is a pattern that should be used with considerable discrimination, as it is not likely to fit the majority of places. The same can be said to a lesser degree of Figs. 7 and 8.

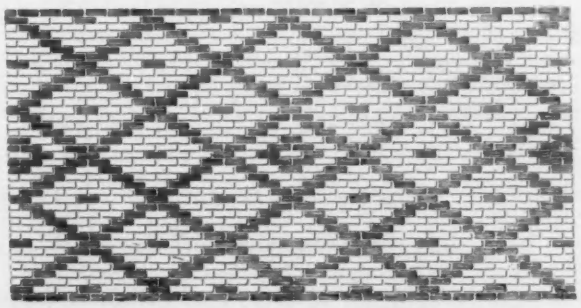
Figs. 9, 10, and 11 show similar motives and variations to Figs. 1, 2, and 3, and are best confined to small surfaces as illustrated in examples a little further.

In Fig. 12 we come to the simplest form of the diamond diaper pattern. This pattern is capable of almost endless variations in treatment, depending upon the sizes of the diamonds and the further treatment of these in point of detail.

Fig. 13 is another band pattern, based upon the diamond motive, as will be seen by examination.

One of the most appropriate uses for patterns of this class is found in the construction of enclosure walls. These walls may be divided into sections, with brick posts or buttresses to stiffen them, but they are better built hollow, and tied with the clever device known as Morse's Patent Wall Tie, a heavy wire, so looped at either end as to get a secure hold in the mortar. A salt glazed coping should be placed on the top, and then to finish give some flowing vine a chance to climb it here and there. For this work, cheap cull brick could be bought, sorted, and laid. It would need only two or three good examples to create, in almost any locality, an entirely new line





of mason contractors' work. As an instance, two applications of the diamond diaper pattern are here given. They are formed of diamonds of the same size, and each has the centre marked. Beyond the difference in these centres the single dark brick in the centre of each diamond is all that makes the difference between them, although the second is a diamond higher and possesses no strongly marked border, — a necessary factor in all over designs applied to a limited space. The second of these designs is taken from a market building in the Avenue des Gobelins, Paris. There and throughout France, brickwork in this bond, and only a single brick thick, is largely used as a filling, or curtain wall for iron or even frame buildings, the brickwork being laid between the iron or wooden posts that do the work in the structure.

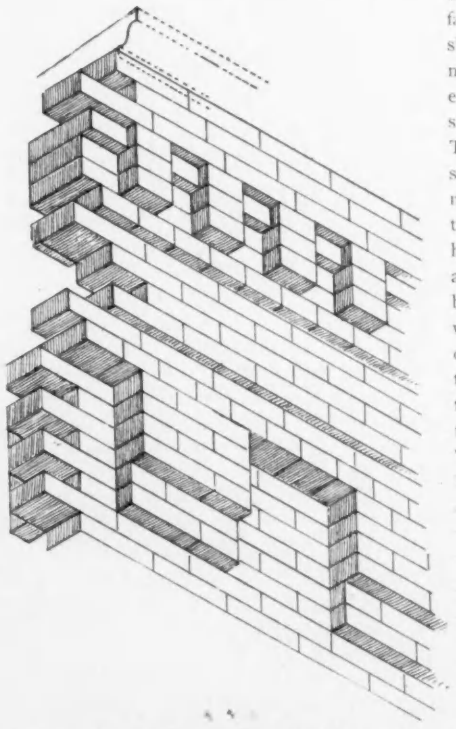
a b c d

As examples of brickwork serving this purpose, in small places, these designs are given. In *a* we have an application of the motive shown in Fig. 11; *b* shows the motive common to 9, 10, and 11; *d* is this motive reversed, the light for the dark; and *c* is the motive of Fig. 1. These small motives can be used also for posts.

In the next issue another full-page plate of American bond motives will be published, with several examples of their application.

A FACTORY CORNICE.

ONE of the best chances for effective brickwork is offered in the construction of large factory and warehouse buildings. These are usually built of good common red brick, with liberal joints of white mortar, giving a result that is almost always pleasing, never offensive. This class of brickwork, in fact, we find used in some of the most expensive buildings of our large cities, where it is used for the plain wall surfaces, the quoins, sills, lintels, cornice, belt courses, etc., being of light stone or terra-cotta. The cornice above shown by an isometric view is twenty-one courses high, and fitted for a three or four story building. It will work out well, requiring about thirty-two brick to the lineal foot, for the *front* work. These brick should be a little more carefully selected than for the main wall, and laid necessarily with more care. It would be well to use a cement mortar, at least for the upper courses, and the top should be tinned or finished with a terra-cotta coping; though if the top courses are carefully laid in cement mortar with a coating of same spread over the top, the tin or terra-cotta may be dispensed with.



Such a cornice will lend dignity and architectural character to the plainest, most utilitarian building. We would like to have our readers estimate the cost of laying this cornice and submit same for publication in our next issue.

THE MANUFACTURER.

A Department devoted to the Market Side of Clay Production.

EXPORTS AND IMPORTS.

THE following facts and figures concerning the trade of brick and kindred lines, with the United States and other countries, have been obtained by the courteous permission of the Treasury Department, from the latest corrected statistics covering these subjects.

The dutiable imports of clays, including kaolin, in July, amounted to 5,517 tons, valued at $41,377, against 5,698 tons, or $41,871 worth in July a year ago. The present year's values, to date of August 1, amounted to 41,167 tons, valued at $328,004, as compared with 41,871 tons, or $366 worth for the corresponding seven months in last year.

The total domestic exports of brick for July amounted to $10,261, against the double amount of $22,167 in July, a year ago; but the year's record, so far, brings up this average. The value for the seven months gone is $86,125, being an increase over the same period in last year, when the value was $80,380.

Of this total there was exported in July, 425,000 building bricks, valued at $2,816, against 522,000 in July, last year, or $4,730 worth. This year's values so far amount to 3,073,000, valued at $22,729, being an increase over this period in last year, when the values were 2,687,000, representing $21,284.

Of this total also were imported fire bricks in July to the value of $7,445, against $17,437 in July last year. The present year's business in this line so far has footed up $63,396, against $59,096 during the corresponding seven months in last year.

There were no re-exports of clays in July against 85 tons, or $802 worth during July last year. This year's values, to date of August 1, have amounted to 50 tons, or $214 worth, as compared with 144 tons, valued at $1,260, in the same period of 1893.

Remaining in customs warehouse in July were 1,075 tons of clay, including kaolin, valued at $8,395, against 1,268 tons, or $10,465 worth, in July last year.

A comparative summary of the amounts and values of clays imported into the Uniied States during the last two fiscal years, that ended with June 30, 1893, and June 30, 1894, reveal some interesting facts.

The total amount exported into the United States during the twelve months that ended with June last was 67,330 tons, valued at $526,543, as compared with 79,200 tons, or $635,368 worth in the previous twelve months that ended with June 30, 1893. From June, 1893 to July, 1894, the last fiscal year, for which official statistics have been compiled, the values for each month, with its comparison of the preceding twelve months, stands as follows: for July, 1893, there were imported 5,678 tons, valued at $41,871, against 4,488 tons, or $36,918 worth in the same month of 1892; in August these values were 5,965 tons, worth $42,033, against 9,902 tons, or $75,913, in August, 1892; in September, 5,330 tons, worth $40,908, against 5,427 tons, worth $45,851, in September, 1892; October, 7,005 tons, or $54,859, against 5,362 tons, or $50,097, in October, 1892; November, 4,000 tons, or $33,876, against 8,148 tons, or $66,322, in November, 1892; December, 3,702 tons, or $26,369, against 4,166 tons, or $35,636, in December, 1892; January, 1894, 5,797 tons, or $47,087, against the preceding January, 1893; February, 4,683 tons, or $37,186, against 8,076 tons, or $61,692, in February, 1893; March, 5,431 tons, or $44,236, against 7,659 tons, or $60,215, for March, 1893; April, 6,944 tons, or $56,713, against 7,509 tons, or $57,057, for April, 1893; May, 7,367 tons, or $58,252, against 6,942 tons, or $43,153, against 6,912 tons, or $51,356, in June, 1893. This twelve months' record shows a falling off in the fiscal year of $108,825, a monthly average in the last fiscal year of $43,879, as compared with $52,947, for the average of the twelve months preceding.

This summary is especially interesting in pointing to the decrease in these imports, for the reason that they suggest a hopeful finale as to the ultimate amount of labor and research expended upon our own home discoveries and possibilities in clay and kaolin mines.

BRICK manufacturers, having stock in two colors, can use, to good advantage, the material on the preceding two pages, by placing this number in the hands of local architects and builders, calling attention at the same time to the shades they manufacture.

LOCAL ADVERTISING.

I.

A Series of Suggestions for the Average Brickmaker.

IF you are making only the ordinary grade of common brick and have no wagons painted with your name, a stock of inexpensive placards can be laid in and if carefully used last a long while and do a great deal of good. These placards can be printed or even stencilled on cloth or some cheap paper board, such as a white surface strawboard. They can be fastened to the side of the wagon, or inserted in a split stick, which can be poked down among the bricks; this latter way is much the better. People will notice it, perhaps talk about it, and little orders that count in the long run will come your way to more than pay for it. As an instance of taking advantage of such things as a dump cart of dirt for advertising, that past master in the art of theatrical advertising, Mr. B. F. Keith, may be mentioned. Mr. Keith originated and has made a fortune out of the continuous performance vaudeville entertainment. He owns theatres in New York, Philadelphia, Providence, and Boston. Here he has built unquestionably the finest theatre of America. Long before the public began to realize what was really going on, thousands of dump-cart loads of dirt were hauled out of the very heart of Boston's retail section, through streets packed with people. Each cart bore a placard, stuck in the dirt, reading, "Excavated from the site of Keith's new theatre." Wagons ordinarily painted and lettered would have passed unnoticed among the thousands of similar ones, but these rough tipcarts with their unique banner made people notice them. This was the beginning of a series of most clever advertisements culminating in a grand opening, since which the new theatre has been full day after day. This idea of placarding is not new, only the particular way of doing it is novel. The cheapest, simplest way of doing it was the best, and yet it was the least common.

IT might pay to send your copy to some mason contractor, who may have on hand a job to which the factory cornice on the preceding would apply. It would count the way all such little business courtesies count, and enterprising men are always on the lookout for chances to pay them.

THE cornices of ornamental brick on page 213 can be built substantially like the designs, from the stock of any manufacturer who has a line of patterns that he makes, and those who are so situated can use this issue to advantage by sending copies marked, with a letter quoting price, to some of the leading builders in their localities.

DESIGNS and details for eight $2,000 brick houses in our special double number. Price per copy, postpaid, 50 cents.